TOSHIBA
Carrier

FILE NO. SVM-10019

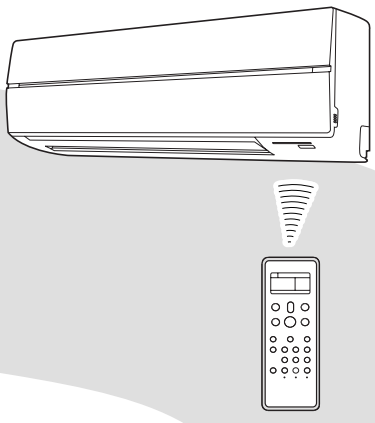
SERVICE MANUAL

AIR-CONDITIONER
SPLIT TYPE

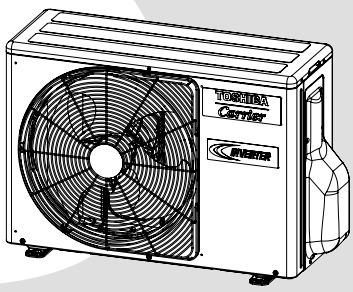
Indoor Unit
<High Wall, Heat Pump Type>

Outdoor Unit
<Heat Pump Type>

RAS-09LKV-UL ***RAS-09LAV-UL***
RAS-12LKV-UL ***RAS-12LAV-UL***



HFC
R410A



Feburary, 2010

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1. SAFETY PRECAUTIONS

Installing, staring up, and servicing air-conditioning equipment can be hazardous due to system pressures, electrical components, and equipment location (roofs, elevated structures, etc.).

Only trained, qualified installers and service mechanics should install, start-up, and service this equipment.

Untrained personnel can perform basic maintenance functions such as cleaning coils. All other operations should be performed by trained service personnel.

When working on the equipment, observe precautions in the literature and on tags, stickers, and labels attached to the equipment.

Follow all safety codes, Wear safety glasses and work gloves. Keep quenching cloth and fire extinguisher near by when brazing. Use care in handling, rigging, and setting bulky equipment.

Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements. Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words : DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol.

DANGER identifies the most serious hazards which will result in severs personal injury or death. WARNING signifies hazards which could result in personal injury or death. CAUTION is used to identify unsafe practices which may result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which will result in enhanced installation, reliability, or operation.

- Before installation, please read these precautions for safety carefully.
- Be sure to follow the precautions provided here to avoid safety risks. The symbols and their meanings are shown below.

WARNING : It indicates that incorrect use of this unit may cause severe injury or death.
CAUTION : FAILURE TO FOLLOW THIS CAUTION may result in equipment damage or improper operation and personal injury.

CAUTION

New refrigerant air conditioner installation

- **THIS AIR CONDITIONER USES THE NEW HFC REFRIGERANT (R410A), WHICH DOES NOT DESTROY THE OZONE LAYER.**
  R410A refrigerant is affected by inpurities such as water and oils because the pressure of R410A refrigerant is approx. 1.6 times of refrigerant R22.
  ALSO NEW OILS ARE USED WITH R410A, THUS ALWAYS USE NEW REFRIGERANT PIPING AND DO NOT ALLOW MOISTURE OR DUST TO ENTER THE SYSTEM.
  To avoid mixing refrigerant and refrigerant machine oil, the sizes of charging port on the main unit is different than those used on R22 machines and different tools will be required.
- **EQUIPMENT DAMAGE HAZARD**
  Failure to follow this caution may result in equipment damage or improper operation.
  Do not bury more than 36 in. (914 mm) of refrigerant pipe in the ground. If any section of pipe is buried, there must be a 6 in. (152 mm) vertical rise to the valve connections on the outdoor units. If more than the recommended length is buried, refrigerant may migrate to the cooter buried section during extended periods of system shutdown. This causes refrigerant slugging and could possibly damage the compressor at start-up.

DANGER

- FOR USE BY QUALIFIED PERSONS ONLY.
- TURN OFF MAIN POWER SUPPLY BEFORE.ATTEMPTING ANY ELECTRICAL WORK. MAKE SURE ALL POWER SWITCHES ARE OFF. FAILURE TO DO SO MAY CAUSE ELECTRIC SHOCK.
- CONNECT THE CONNECTING CABLE CORRECTLY. IF THE CONNECTING CABLE IS CONNECTED WRONGLY, ELECTRIC PARTS MAY BE DAMAGED.
- CHECK THE EARTH WIRE THAT IT IS NOT BROKEN OR DISCONNECTED BEFORE INSTALLATION.
- DO NOT INSTALL NEAR CONCENTRATIONS OF COMBUSTIBLE GAS OR GAS VAPORS. FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN FIRE OR EXPLOSION.
- TO PREVENT OVERHEATION THE INDOOR UNIT AND CAUSING A FIRE HAZARD, PLACE THE UNIT WELL AWAY (MORE THAN 2 M) FROM HEAT SOURCES SUCH AS RADIATORS, HEATERS, FURNACE, STOVES, ETC.
- WHEN MOVING THE AIR CONDITIONER FOR INSTALLING IT IN ANOTHER PLACE AGAIN, BE VERY CAREFUL NOT TO GET THE SPECIFIED REFRIGERANT (R410A) WITH ANY OTHER GASEOUS BODY INTO THE REFRIGERATION CYCLE. IF AIR OR ANY OTHER GAS IS MIXED IN THE REFRIGERANT, THE GAS PRESSURE IN THE REFRIGERATION CYCLE BECOMES ABNORMALLY HIGH AND IT RESULTINGLY CAUSES BURST OF THE PIPE AND INJURIES ON PERSONS.
- IN THE EVENT THAT THE REFRIGERANT LEAK, DURING INSTALLATION WORK, IMMEDIATELY ALLOW FRESH AIR INTO THE ROOM. IF THE REFRIGERANT GAS IS HEATED BY FIRE OR SOMETHING ELSE, IT CAUSE GENERATION OF POISONOUS GAS.

WARNING

- **ELECTRICAL SHOCK HAZARD**
  Failure to follow this warning could result in personal injury or death.
  Before installing, modifying, or servicing system, main electrical disconnect switch must be in the OFF position. There may be more than 1 disconnect switch. Lock out and tag switch with a suitable warning label.
- Never modify this unit by removing any of the safety guards or bypassing any of the safety interlock switches.
- Installation work must be purformed by qualified personnel only.
- Specified tools and pipe parts for model R410A are required, and installation work must be done in accordance with the manual. HFC type refrigerant R410A has 1.6 times more pressure than that of conventional refrigerant (R22). Use the specified pipe parts, and ensure correct installation, otherwise damage and/or injury may be caused. At the same time, water leakage, electrical shock, and fire may occur.
- Be sure to install the unit in a place which can sufficiently bear its weight. If the load bearing of the unit is not enough, or installation of the unit is improper, the unit may fall and result in injury.
- Electrical work must be performed by trained, qualified installers and service mechanics in accordance with the code governing such installation work, internal wiring regulations, and the manual. A dedicated circuit and the rated voltage must be used. Insufficient power supply or improper installation may cause electrical shock or fire.
- Use a cabtyre cable to connect wires in the indoor/outdoor units. Midway connection is not allowed. Improper connection or fixing may cause a fire.
- Wiring between the indoor unit and outdoor units must be well shaped so that the cover can be firmly placed. Improper cover installation may cause increased heat, fire, or electrical shock at the terminal area.
- Be sure to use only approved accessories or the specified parts. Failure to do so may cause the unit to fall, water leakage, fire or electrical shock.
- After the installation work. ensure that there is no leakage of refrigerant gas. If the refrigerant gas leaks out of the pipe into the room and is heated by fire or something else from a fanheater, stove or gas range, it causes generation of poisonous gas.
- Make sure the equipment is properly grounded. Do not connect the ground wire to a gas pipe, water pipe, lightning conductor, or telephone earth wire. Improper earth work may be the cause of electrical shock.
- Do not install the unit where flammable gas may leak. If there is any gas leakage or accumulation around the unit, it can cause a fire.
- Do not select a location for installation where there may be excessive water or humidity, such as a bathroom. Deterioration of insulation nay cause electrical shock or fire.
- Installation work must be performed following the instructions in this installation manual. Improper installation may cause water leakage, electrical shock or fire. Check the following items before operating the unit.
  - Be sure that the pipe connection is well placed and there are no leaks.
  - Check that the service valve is open. If the service valve is closed, it may cause overpressure and result in compressor damage. At the same time, if there is a leak in the connection part, it may cause air suction and overpressure, resulting in damage to the unit or injury.
- In a pump-down operation, be sure to stop the compressor unit before removing the refrigerant pipe. If removing the refrigerant pipe while the compressor is operating with the service valve opened, it may cause air suction and overpressure, resulting in damage to the unit or injury.
- Do not modity the power cable, connect the cable midway, or use a multiple outlet extension cable. Doing so may cause contact failure, insulation failure, or excess current, resulting in fire or electrical shock.
- If you detect any damage, do not install the unit. Contact your dealer immediately.

CAUTION

- Exposure of unit to water or other moisture before installation could result in electric shock. Do not store it in a wet basement or expose to rain or water.
- After unpacking the unit, examine it carefully for possible damage. Report any damages to your distributor.
- Do not install in a place that can increase the vibration of the unit. Do not install in a place that can amplify the noise level of the unit or where noise and discharged air might disturb neighbors.
- Please read this installation manual carefully before installing the unit. It contains further important instructions for proper installation.
- This appliance must be connected to the main power supply by means of a circuit breaker depending on the place where the unit is installed. Failure to do so may cause electrical shock.
- Follow the instructions in this installation manual to arrange the drain pipe for proper drainage from the unit. Ensure that drained water is discharged. Improper drainage can result is water leakage, causing water damage to furniture.
- Tighten the flare nut with a torque wrench using the prescribed method. Do not apply excess torque. Otherwise, the nut may crack after a long period of usage and it may cause the leakage of refrigerant.
- Wear gloves (heavy gloves such as cotton gloves) for installation work. Failure to do so may cause personal injury when handling parts with sharp edges.
- Do not touch the air intake section or the aluminum fins of the outdoor unit. It may cause injury.
- Do not install the outdoor unit in a place which can be a nest for small animals. Small animals could enter and contact internal electrical parts, causing a failure or fire.
- Request the user to keep the place around the unit tidy and clean.
- Make sure to conduct a trial operation after the installation work, and explain how to use and maintain the unit to the customer in accordance with the manual. Ask the customer to keep the operation manual along with the installation manual.

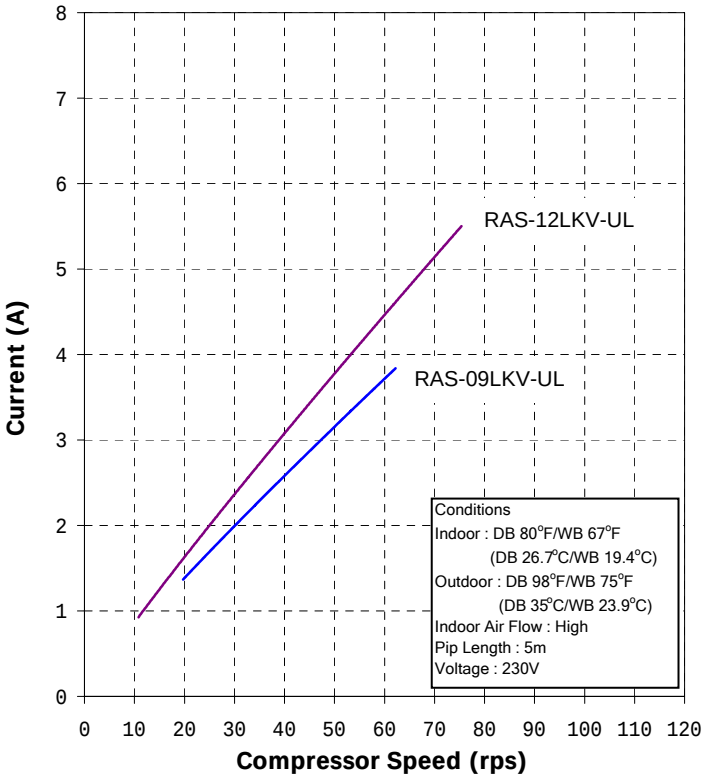
2. SPECIFICATIONS

Unit model	Indoor			**RAS-09LKV-UL**		**RAS-12LKV-UL**	
	Outdoor			**RAS-09LAV-UL**		**RAS-12LAV-UL**	
Cooling capacity			(Btu/h)	9000		12000	
Cooling capacity range			(Btu/h)	3750 -10580		2750 - 13950	
Heating capacity			(Btu/h)	10800		14200	
Heating capacity range			(Btu/h)	3070 - 16350		3070 - 19000	
Power supply				1Ph, 60Hz, 208V/230V		1Ph, 60Hz, 208V/230V	
Electric characteristic	Indoor	Operation mode		**Cooling**	**Heating**	**Cooling**	**Heating**
		Running current	(A)	0.22	0.20	0.25	0.23
		Power consumption	(W)	35	40	30	35
		Power factor	(%)	76	76	66	66
	Outdoor	Operation mode		**Cooling**	**Heating**	**Cooling**	**Heating**
		Running current	(A)	3.46	3.13	5.26	4.76
		Power consumption	(W)	655	760	920	1055
		Power factor	(%)	91	94	95	95
		Starting current	(A)	3.68	3.33	4.81/4.35	5.51/4.99
EER (Cooling/Heating)			(Btu/W.h)	13.0/13.5		12.6 / 13.0	
SEER (Btu/W.h) / HSPF (w/w)				20.0/10.0		23.0/9.5	
Operating noise	Indoor	High (Cooling/Heating)	(dB-A)	39/40		45/46	
		Medium (Cooling/Heating)	(dB-A)	34/35		40/41	
		Low (Cooling/Heating)	(dB-A)	27/29		30/32	
	Outdoor	(Cooling/Heating)	(dB-A)	47/47		50/50	
Indoor unit	Unit model			**RAS-09LKV-UL**		**RAS-12LKV-UL**	
	Dimension	Height	in. (mm)	10-25/32 (275)		10-25/32 (275)	
		Width	in. (mm)	31-1/8 (790)		31-1/8 (790)	
		Depth	in. (mm)	8-1/16 (205)		8-1/16 (205)	
	Net weight		lbs (kg)	20 (9)		20 (9)	
	Fan motor output		(W)	20		30	
	Air flow rate	(Cooling/Heating)	cfm (m^3/min)	303/335 (8.6)/(9.5)		406/438 (11.5/12.4)	
Outdoor unit	Unit model			**RAS-09LAV-UL**		**RAS-12LAV-UL**	
	Dimension	Height	in. (mm)	21-11/16 (550)		21-11/16 (550)	
		Width	in. (mm)	30-11/16 (780)		30-11/16 (780)	
		Depth	in. (mm)	11-7/16 (290)		11-7/16 (290)	
	Net weight		lbs (kg)	75 (34)		88 (39)	
	Compressor	Motor output	(w)	750		750	
		Type		Single rotary type with DC-inverter variable speed control		Twin rotary type with DC-inverter variable speed control	
		Model		DA89X1C-23FZ2		DA111A1F-20F1	
	Fan motor output		(W)	43		43	
	Air flow rate	(Cooling/Heating)	cfm (m^3/min)	1060/1060 (30)/(30)		1395/1236 (39.5/35.0)	
Piping connection	Type			Flare connection		Flare connection	
	Indoor unit	Liquid side	in. (mm)	∅1/4 (∅6.35)		∅1/4 (∅6.35)	
		Gas side	in. (mm)	∅3/8 (∅9.92)		∅3/8 (∅9.92)	
	Outdoor unit	Liquid side	in. (mm)	∅1/4 (∅6.35)		∅1/4 (∅6.35)	
		Gas side	in. (mm)	∅3/8 (∅9.92)		∅3/8 (∅9.92)	
	Maximum length		ft. (m)	66 (20)		66 (20)	
	Maximum chargeless length		ft. (m)	50 (15)		50 (15)	
	Maximum height difference		ft. (m)	33 (10)		33 (10)	
Refrigerant	Name of refrigerant			R410A		R410A	
	Weight		lbs (kg)	1.77 (0.8)		2.43 (1.10)	
Wiring connection	Power supply			3Wires:includes earth (Outdoor)		3Wires:includes earth (Outdoor)	
	Interconnection			4Wires:includes earth		4Wires:includes earth	
Usable temperature range	Indoor	(Cooling/Heating)	°F (°C)	70-90 / 32-82 (21-32/0-28)		70-90 / 32-82 (21-32/0-28)	
	Outdoor	(Cooling/Heating)	°F (°C)	14-115 / 5-75 (-10-46/-15-24)		14-115 / 5-75 (-10-46/-15-24)	

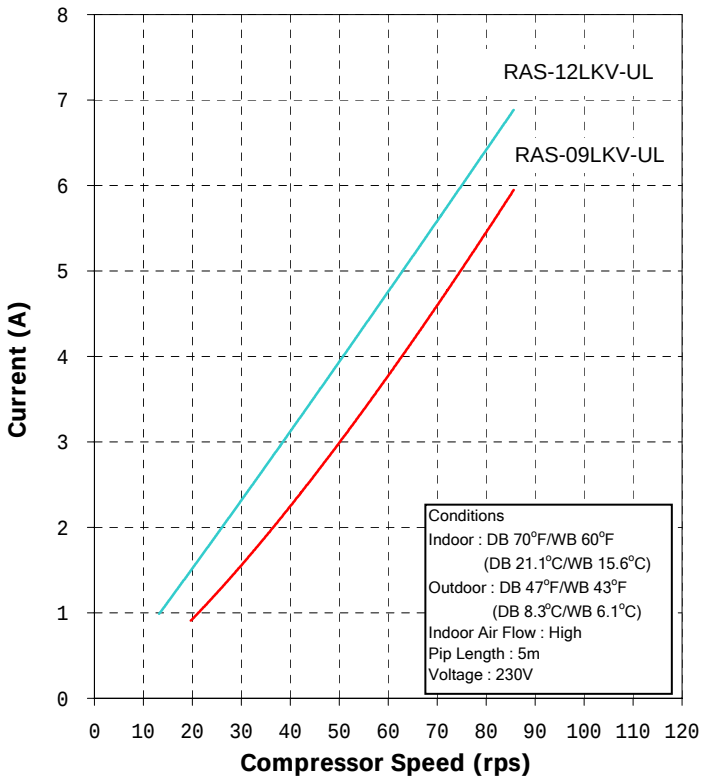
* The specifications may be subject to change without notice for purpose of improvement.

2-2. Operation Characteristic Curve

<Cooling>

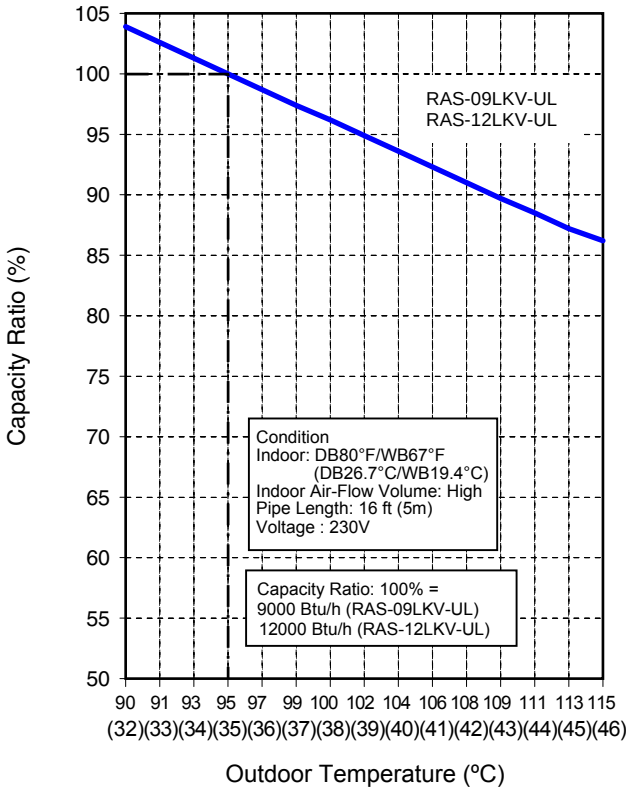


<Heating>



2-3. Capacity Variation Ratio According to Temperature

<Cooling>



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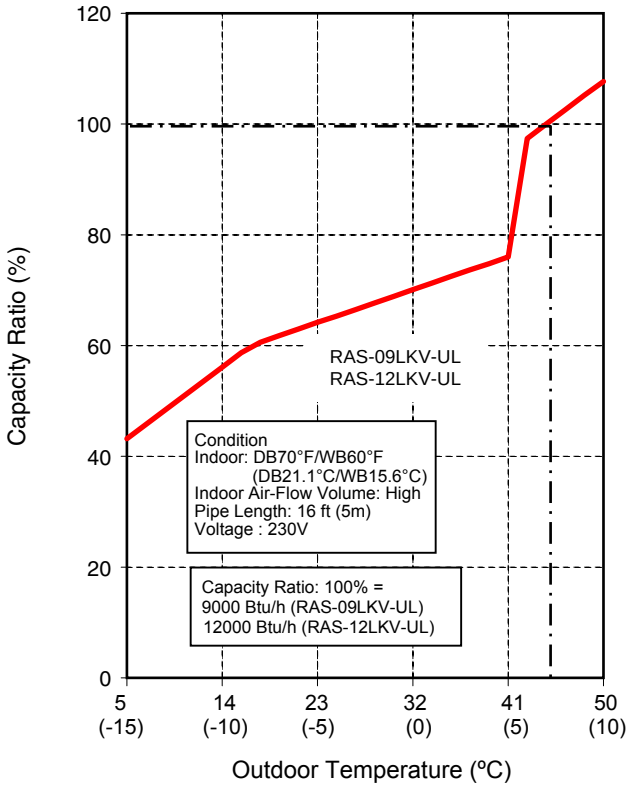


3. REFRIGERANT R410A

This air conditioner adopts the new refrigerant HFC (R410A) which does not damage the ozone layer.

The working pressure of the new refrigerant R410A is 1.6 times higher than conventional refrigerant (R22). The refrigerating oil is also changed in accordance with change of refrigerant, so be careful that water, dust, and existing refrigerant or refrigerating oil are not entered in the refrigerant cycle of the air conditioner using the new refrigerant during installation work or servicing time.

The next section describes the precautions for air conditioner using the new refrigerant. Conforming to contents of the next section together with the general cautions included in this manual, perform the correct and safe work.

3-1. Safety During Installation/Servicing

As R410A's pressure is about 1.6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration.

1. Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A.

   If other refrigerant than R410A is mixed, pressure in the refrigeration cycle becomes abnormally high, and it may cause personal injury, etc. by a rupture.
2. Confirm the used refrigerant name, and use tools and materials exclusive for the refrigerant R410A.

   The refrigerant name R410A is indicated on the visible place of the outdoor unit of the air conditioner using R410A as refrigerant. To prevent mischarging, the diameter of the service port differs from that of R22.
3. If a refrigeration gas leakage occurs during installation/servicing, be sure to ventilate fully.

   If the refrigerant gas comes into contact with fire, a poisonous gas may occur.
4. When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture or personal injury may be caused.
5. After completion of installation work, check to make sure that there is no refrigeration gas leakage.

   If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc., a poisonous gas may occur.
6. When an air conditioning system charged with a large volume of refrigerant is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level.

   If the refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result.
7. Be sure to carry out installation or removal according to the installation manual.

   Improper installation may cause refrigeration trouble, water leakage, electric shock, fire, etc.
8. Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician.

   Improper repair's may result in water leakage, electric shock and fire, etc.

3-2. Refrigerant Piping Installation

3-2-1. Piping Materials and Joints Used

For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants.

1. Copper Pipes

It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10 m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface).

Otherwise, the expansion valve or capillary tube may become blocked with contaminants.

As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.

Thicknesses of copper pipes used with R410A are as shown in Table 3-2-1. Never use copper pipes thinner than 0.0315 in. (0.8 mm) even when it is available on the market.

Table 3-2-1 Thicknesses of annealed copper pipes

		Thickness in. (mm)	
Nominal diameter (in.)	**Outer diameter (mm)**	**R410A**	**R22**
1/4	6.35	0.0315 (0.80)	0.0315 (0.80)
3/8	9.52	0.0315 (0.80)	0.0315 (0.80)
1/2	12.70	0.0315 (0.80)	0.0315 (0.80)

2. Joints

For copper pipes, flare joints or socket joints are used. Prior to use, be sure to remove all contaminants.

a) Flare Joints

Flare joints used to connect the copper pipes cannot be used for pipings whose outer diameter exceeds 20 mm. In such a case, socket joints can be used.

Sizes of flare pipe ends, flare joint ends and flare nuts are as shown in Tables 3-2-3 to 3-2-6 below.

b) Socket Joints

Socket joints are such that they are brazed for connections, and used mainly for thick pipings whose diameter is larger than 0.7874 in. (20 mm).

Thicknesses of socket joints are as shown in Table 3-2-2.

Table 3-2-2 Minimum thicknesses of socket joints

Nominal diameter (in)	Reference outer diameter of copper pipe jointed (mm)	Minimum joint thickness in. (mm)
1/4	6.35	0.0197 (0.50)
3/8	9.52	0.0236 (0.60)
1/2	12.70	0.0276 (0.70)

3-2-2. Processing of Piping Materials

When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil than lubricating oils used in the installed air-water heat pump is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed. When stored, be sure to seal the container with an airtight cap or any other cover.

1. Flare processing procedures and precautions

a) Cutting the Pipe

By means of a pipe cutter, slowly cut the pipe so that it is not deformed.

b) Removing Burrs and Chips

If the flared section has chips or burrs, refrigerant leakage may occur.
Carefully remove all burrs and clean the cut surface before installation.

c) Insertion of Flare Nut

d) Flare Processing

Make certain that a clamp bar and copper pipe have been cleaned.

By means of the clamp bar, perform the flare processing correctly.

Use either a flare tool for R410A or conventional flare tool.

Flare processing dimensions differ according to the type of flare tool. When using a conventional flare tool, be sure to secure “dimension A” by using a gauge for size adjustment.

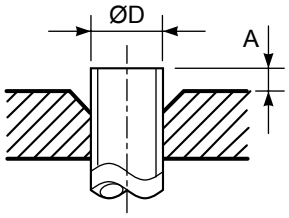


Fig. 3-2-1 Flare processing dimensions

Table 3-2-3 Dimensions related to flare processing for R410A

Nominal diameter in.	Outer diameter (mm)	Thickness in. (mm)	A in. (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.0591 to 0.0787 (1.5 to 2.0)
3/8	9.52	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.0591 to 0.0787 (1.5 to 2.0)
1/2	12.70	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0394 to 0.0591 (1.0 to 1.5)	0.07874 to 0.0984 (2.0 to 2.5)

Table 3-2-4 Dimensions related to flare processingf or R22

Nominal diameter in.	Outer diameter (mm)	Thickness in. (mm)	A in. (mm)		
			Flare tool for R22 clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0394 to 0.0591 (1.0 to 1.5)
3/8	9.52	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0394 to 0.0591 (1.0 to 1.5)
1/2	12.70	0.0315 (0.8)	0 to 0.0197 (0 to 0.5)	0.0197 to 0.0394 (0.5 to 1.0)	0.0591 to 0.0787 (1.5 to 2.0)

Table 3-2-5 Flare and flare nut dimensions for R410A

Nominal diameter in.	Outer diameter (mm)	Thic kness in. (mm)	Dimension in. (mm)				Flare nut width in. (mm)
			A	B	C	D	
1/4	6.35	0.0315 (0.8)	0.358 (9.1)	0.362 (9.2)	0.256 (6.5)	0.512 (13)	0.669 (17)
3/8	9.52	0.0315 (0.8)	0.520 (13.2)	0.531 (13.5)	0.382 (9.7)	0.787 (20)	0.866 (22)
1/2	12.70	0.0315 (0.8)	0.630 (16.0)	0.653 (16.6)	0.508 (12.9)	0.906 (23)	1.024 (26)

Table 3-2-6 Flare and flare nut dimensions for R22

Nominal diameter in.	Outer diameter (mm)	Thic kness in. (mm)	Dimension in. (mm)				Flare nut width in. (mm)
			A	B	C	D	
1/4	6.35	0.0315 (0.8)	0.354 (9.0)	0.362 (9.2)	0.256 (6.5)	0.512 (13)	0.669 (17)
3/8	9.52	0.0315 (0.8)	0.512 (13.0)	0.531 (13.5)	0.382 (9.7)	0.787 (20)	0.866 (22)
1/2	12.70	0.0315 (0.8)	0.630 (16.0)	0.638 (16.2)	0.508 (12.9)	0.787 (20)	0.945 (24)

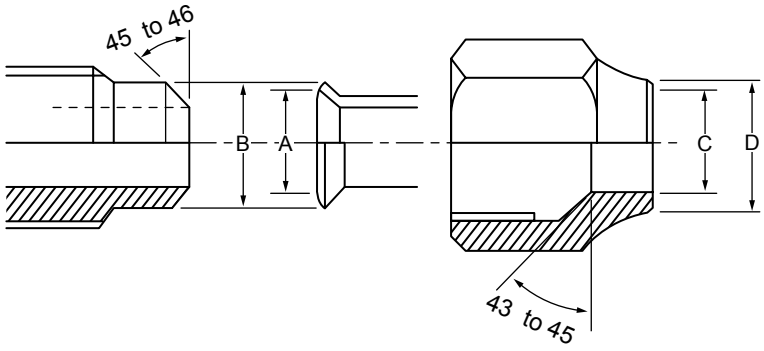


Fig. 3-2-2 Relations between flare nut and flare seal surface

2. Flare Connecting Procedures and Precautions

a) Make sure that the flare and union portions do not have any scar or dust, etc.

b) Correctly align the processed flare surface with the union axis.

c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for conventional R22. Incidentally, when the torque is weak, the gas leakage may occur. When it is strong, the flare nut may crack and may be made non-removable. When choosing the tightening torque, comply with values designated by manufacturers. Table 3-2-7 shows reference values.

NOTE :

When applying oil to the flare surface, be sure to use oil designated by the manufacturer.
If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out.

Table 3-2-7 Tightening torque of flare for R410A [Reference values]

Nominal diameter in.	Outer diameter (mm)	Tightening torque lbf.ft (N•m)	Tightening torque of torque wrenches available on the market lbf.ft (N•m)
1/4	6.35	10 to 13 (14 to 18)	12 (16), 13 (18)
3/8	9.52	24 to 31 (33 to 42)	31 (42)
1/2	12.70	37 to 46 (50 to 62)	41 (55)

3-3. Tools

3-3-1. Required Tools

The service port diameter of packed valve of the outdoor unit in the air-water heat pump using R410A is changed to prevent mixing of other refrigerant. To reinforce the pressure-resisting strength, flare processing dimensions and opposite side dimension of flare nut (For ∅1/2 in. 12.7mm) copper pipe) of the refrigerant piping are lengthened.

The used refrigerating oil is changed, and mixing of oil may cause a trouble such as generation of sludge, clogging of capillary, etc. Accordingly, the tools to be used are classified into the following three types.

1. Tools exclusive for R410A (Those which cannot be used for conventional refrigerant (R22))
2. Tools exclusive for R410A, but can be also used for conventional refrigerant (R22)
3. Tools commonly used for R410A and for conventional refrigerant (R22)

The table below shows the tools exclusive for R410A and their interchangeability.

Tools exclusive for R410A (The following tools for R410A are required.)

Tools whose specifications are changed for R410A and their interchangeability

No.	Used tool	Usage	R410A air-water heat pump installation		Conventional air-water heat pump installation
			Existence of new equipment for R410A	Whether conventional equipment can be used	Whether new equipment can be used with conventional refrigerant
1	Flare tool	Pipe flaring	Yes	***(Note 1)**	○
2	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	***(Note 1)**	***(Note 1)**
3	Torque wrench [(For Ø1/2 (12.7mm)]	Connection of flare nut	Yes	×	×
4	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	×	×
5	Charge hose				
6	Vacuum pump adapter	Vacuum evacuating	Yes	×	○
7	Electronic balance for refrigerant charging	Refrigerant charge	Yes	×	○
8	Refrigerant cylinder	Refrigerant charge	Yes	×	×
9	Leakage detector	Gas leakage check	Yes	×	○
10	Charging cylinder	Refrigerant charge	**(Note 2)**	×	×

(Note 1) When flaring is carried out for R410A using the conventional flare tools, adjustment of projection margin is necessary. For this adjustment, a copper pipe gauge, etc. are necessary.

(Note 2) Charging cylinder for R410A is being currently developed.

General tools (Conventional tools can be used.)

In addition to the above exclusive tools, the following equipments which serve also for R22 are necessary as the general tools.

1. Vacuum pump
   Use vacuum pump by attaching vacuum pump adapter.
2. Torque wrench [For Ø1/4, Ø3/8 in. (∅6.35, ∅9.52mm)]
3. Pipe cutter
4. Reamer
5. Pipe bender
6. Level vial
7. Screwdriver (+, –)
8. Spanner or Monkey wrench
9. Hole core drill [Ø2-9/16 in. (65mm)]
10. Hexagon wrench [Opposite side 3/16 in. (4mm)]
11. Tape measure
12. Metal saw

Also prepare the following equipments for other installation method and run check.

1. Clamp meter
2. Thermometer
3. Insulation resistance tester
4. Electroscope

3-4. Recharging of Refrigerant

When it is necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps.

Recover the refrigerant, and check no refrigerant remains in the equipment.

↓

Connect the charge hose to packed valve service port at the outdoor unit's gas side.

↓

Connect the charge hose to the vacuum pump adapter.

↓

Open fully both packed valves at liquid and gas sides.

↓

Place the handle of the gauge manifold Low in the fully opened position, and turn on the vacuum pump's power switch. Then, evacuating the refrigerant in the cycle.

↓

When the compound gauge's pointer has indicated −14.7 Psi (–0.1 Mpa) or −29.9 inHg (–76 cmHg), place the handle Low in the fully closed position, and turn off the vacuum pump's power switch.

↓

Keep the status as it is for 1 to 2 minutes, and ensure that the compound gauge's pointer does not return.

↓

Set the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and charge **liquid refrigerant**.

(For refrigerant charging, see the figure below.)

1. Never charge refrigerant exceeding the specified amount.
2. If the specified amount of refrigerant cannot be charged, charge refrigerant **bit by bit** in COOL mode.
3. Do not carry out additional charging.
   When additional charging is carried out if refrigerant leaks, the refrigerant composition changes in the refrigeration cycle, that is characteristics of the air conditioner changes, refrigerant exceeding the specified amount is charged, and working pressure in the refrigeration cycle becomes abnormally high pressure, and may cause a rupture or personal injury.

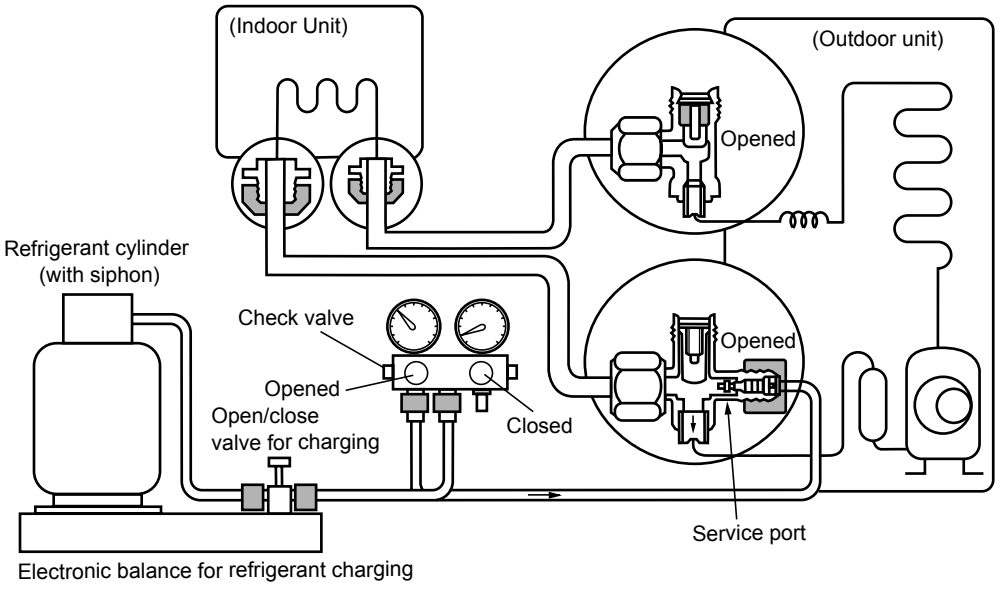
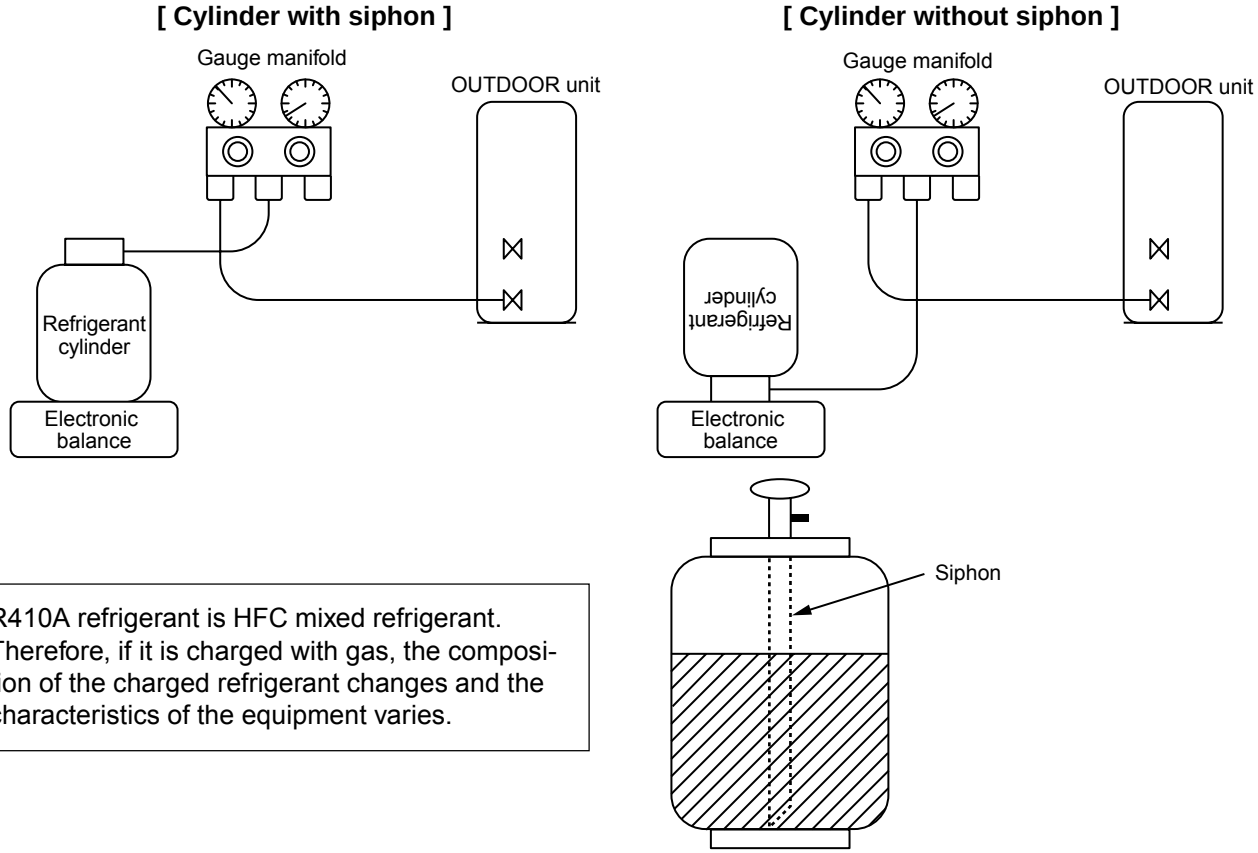


Fig. 3-4-1 Configuration of refrigerant charging

1. Be sure to make setting so that **liquid** can be charged.
2. When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down.

It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon.



R410A refrigerant is HFC mixed refrigerant. Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies.

Fig. 3-4-2

3-5. Brazing of Pipes

3-5-1. Materials for Brazing

1. Silver brazing filler

Silver brazing filler is an alloy mainly composed of silver and copper. It is used to join iron, copper or copper alloy, and is relatively expensive though it excels in solderability.

2. Phosphor bronze brazing filler

Phosphor bronze brazing filler is generally used to join copper or copper alloy.

3. Low temperature brazing filler

Low temperature brazing filler is generally called solder, and is an alloy of tin and lead. Since it is weak in adhesive strength, do not use it for refrigerant pipes.

1. Phosphor bronze brazing filler tends to react with sulfur and produce a fragile compound water solution, which may cause a gas leakage. Therefore, use any other type of brazing filler at a hot spring resort, etc., and coat the surface with a paint.
2. When performing brazing again at time of servicing, use the same type of brazing filler.

3-5-2. Flux

1. Reason why flux is necessary

- By removing the oxide film and any foreign matter on the metal surface, it assists the flow of brazing filler.
- In the brazing process, it prevents the metal surface from being oxidized.
- By reducing the brazing filler's surface tension, the brazing filler adheres better to the treated metal.

2. Characteristics required for flux

- Activated temperature of flux coincides with the brazing temperature.
- Due to a wide effective temperature range, flux is hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing filler is minimum.
- It excels in coating performance and is harmless to the human body.

As the flux works in a complicated manner as described above, it is necessary to select an adequate type of flux according to the type and shape of treated metal, type of brazing filler and brazing method, etc.

3. Types of flux

- **Noncorrosive flux**

  Generally, it is a compound of borax and boric acid.
  It is effective in case where the brazing temperature is higher than 1472°F (800°C).

- **Activated flux**

  Most of fluxes generally used for silver brazing are this type.
  It features an increased oxide film removing capability due to the addition of compounds such as potassium fluoride, potassium chloride and sodium fluoride to the borax-boric acid compound.

4. Piping materials for brazing and used brazing filler/flux

Piping material	Used brazing filler	Used flux
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapor flux

1. Do not enter flux into the refrigeration cycle.
2. When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine.
3. When adding water to the flux, use water which does not contain chlorine (e.g. distilled water or ion-exchange water).
4. Remove the flux after brazing.

3-5-3. Brazing

As brazing work requires sophisticated techniques, experiences based upon a theoretical knowledge, it must be performed by a person qualified.

In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry Nitrogen gas (N2) flow.

Never use gas other than Nitrogen gas.

1. Brazing method to prevent oxidation

1) Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder.
2) Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder.
3) Apply a seal onto the clearance between the piping material and inserted copper pipe for Nitrogen in order to prevent backflow of the Nitrogen gas.
4) When the Nitrogen gas is flowing, be sure to keep the piping end open.
5) Adjust the flow rate of Nitrogen gas so that it is lower than 0.03 cfm (0.05 m^3/Hr) or 2.9 Psi (0.02 MPa) by means of the reducing valve.
6) After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands).
7) Remove the flux completely after brazing.

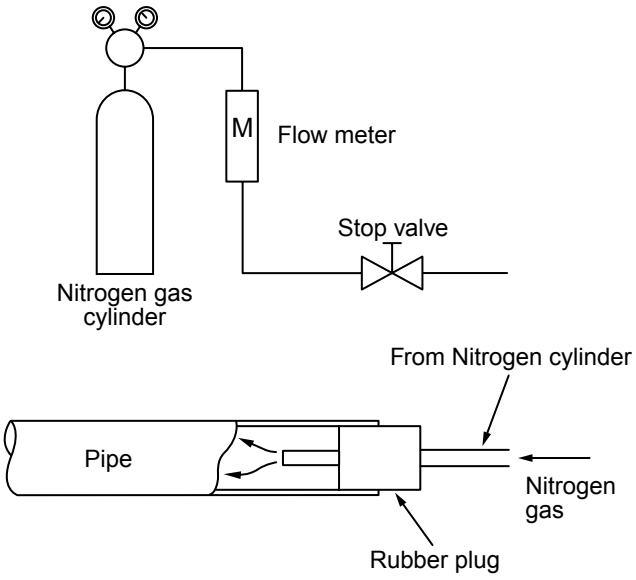
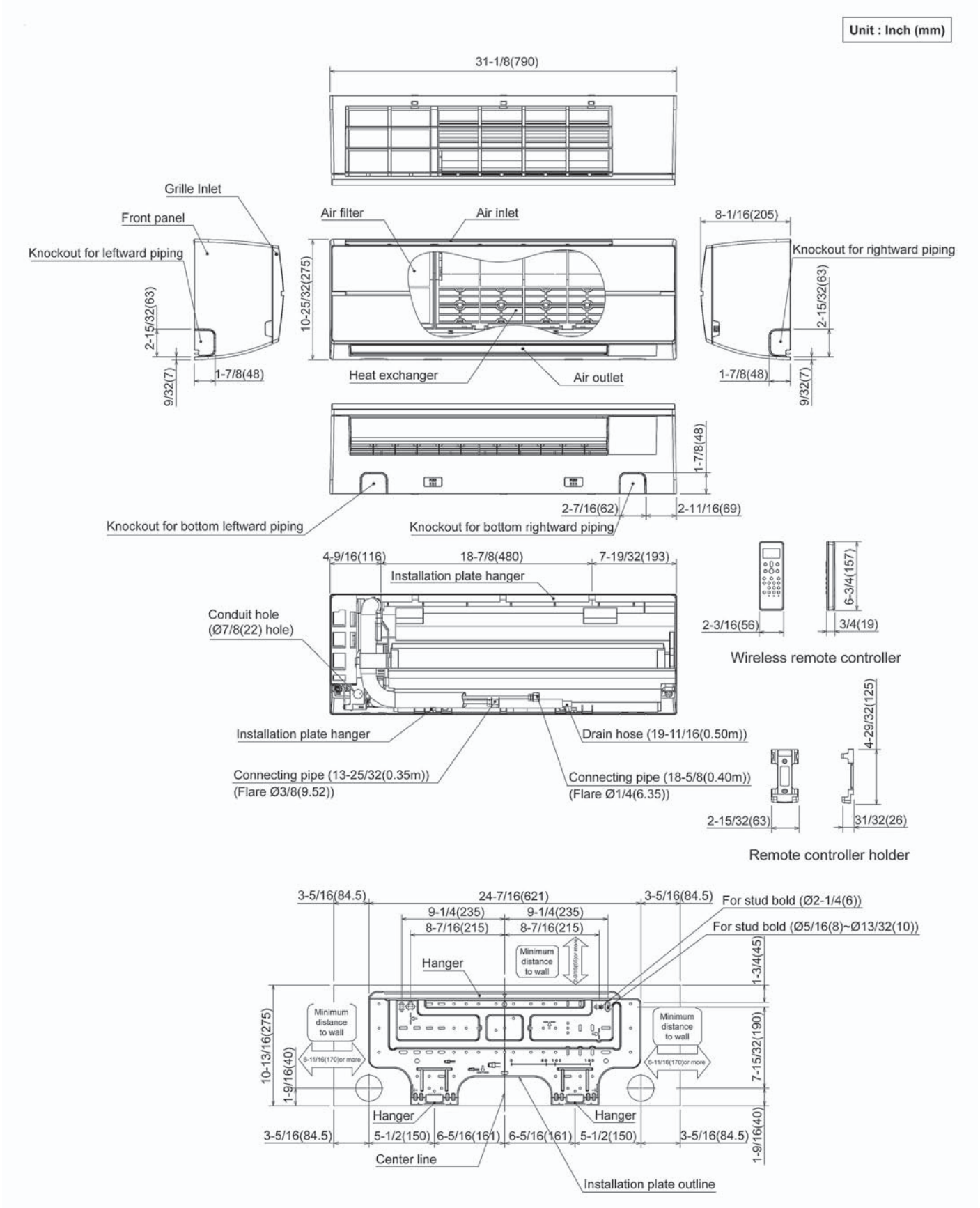


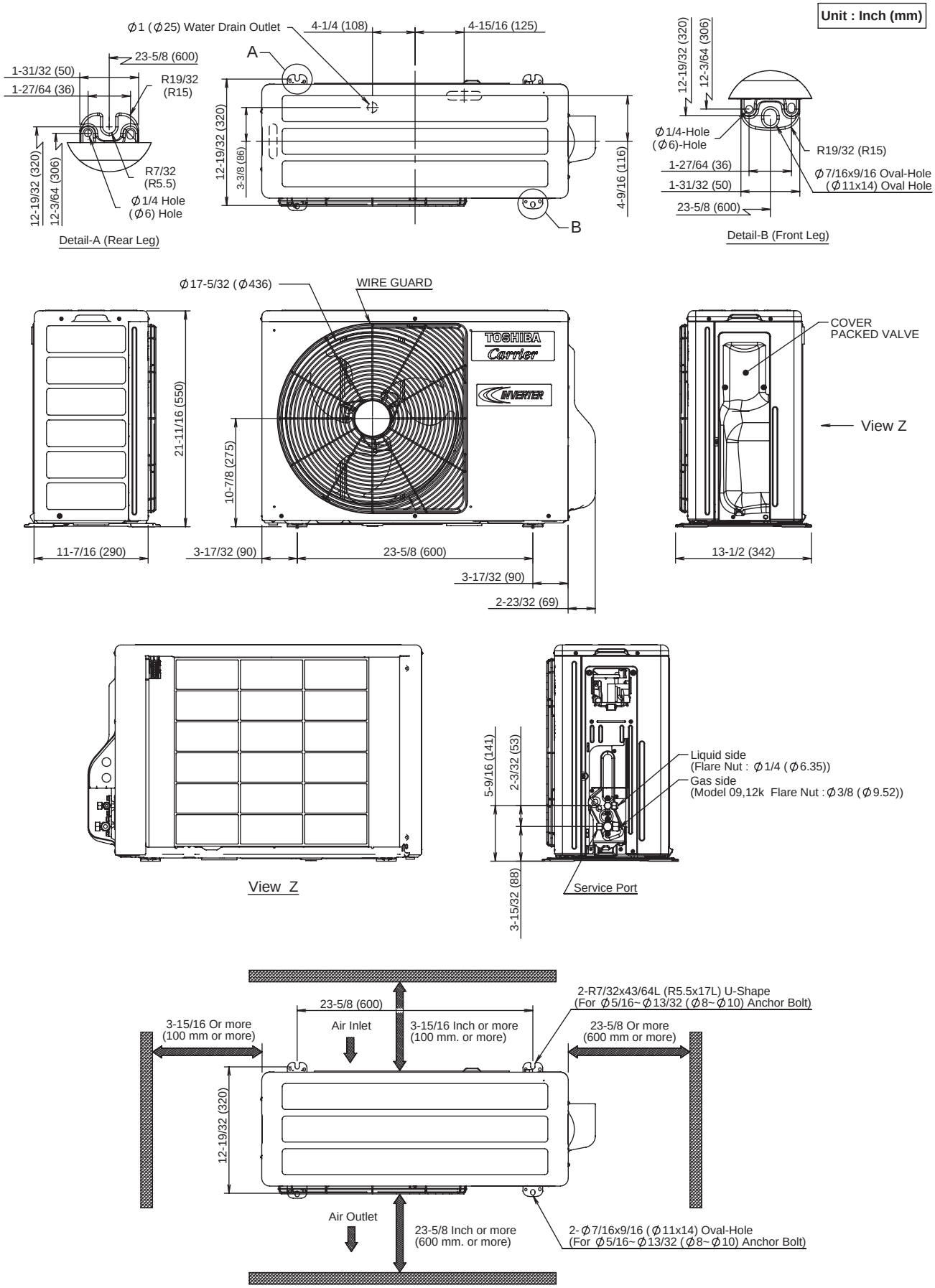
Fig. 3-5-1 Prevention of oxidation during brazing

4. CONSTRUCTION VIEWS

4-1. Indoor Unit

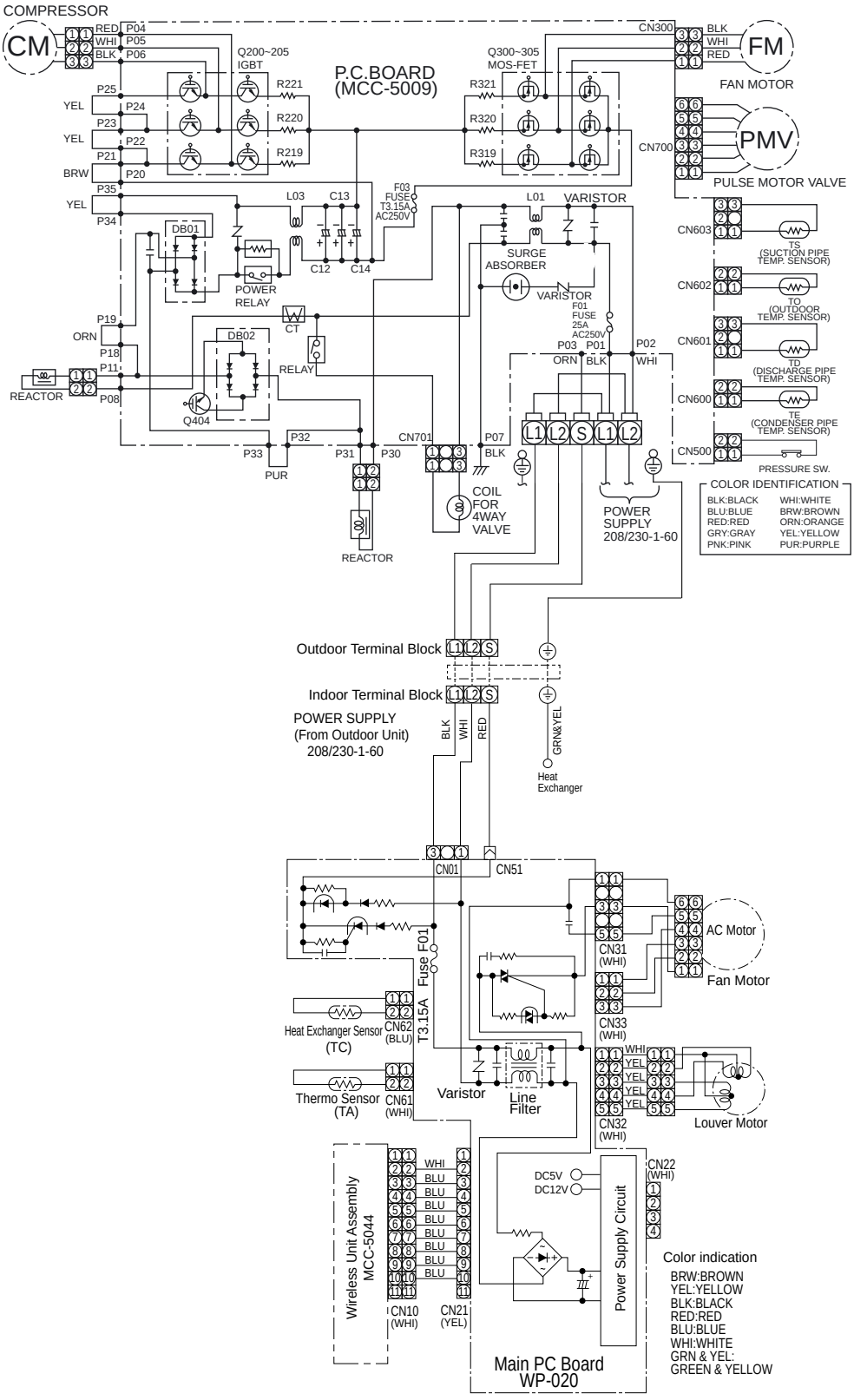


4-2. Outdoor Unit

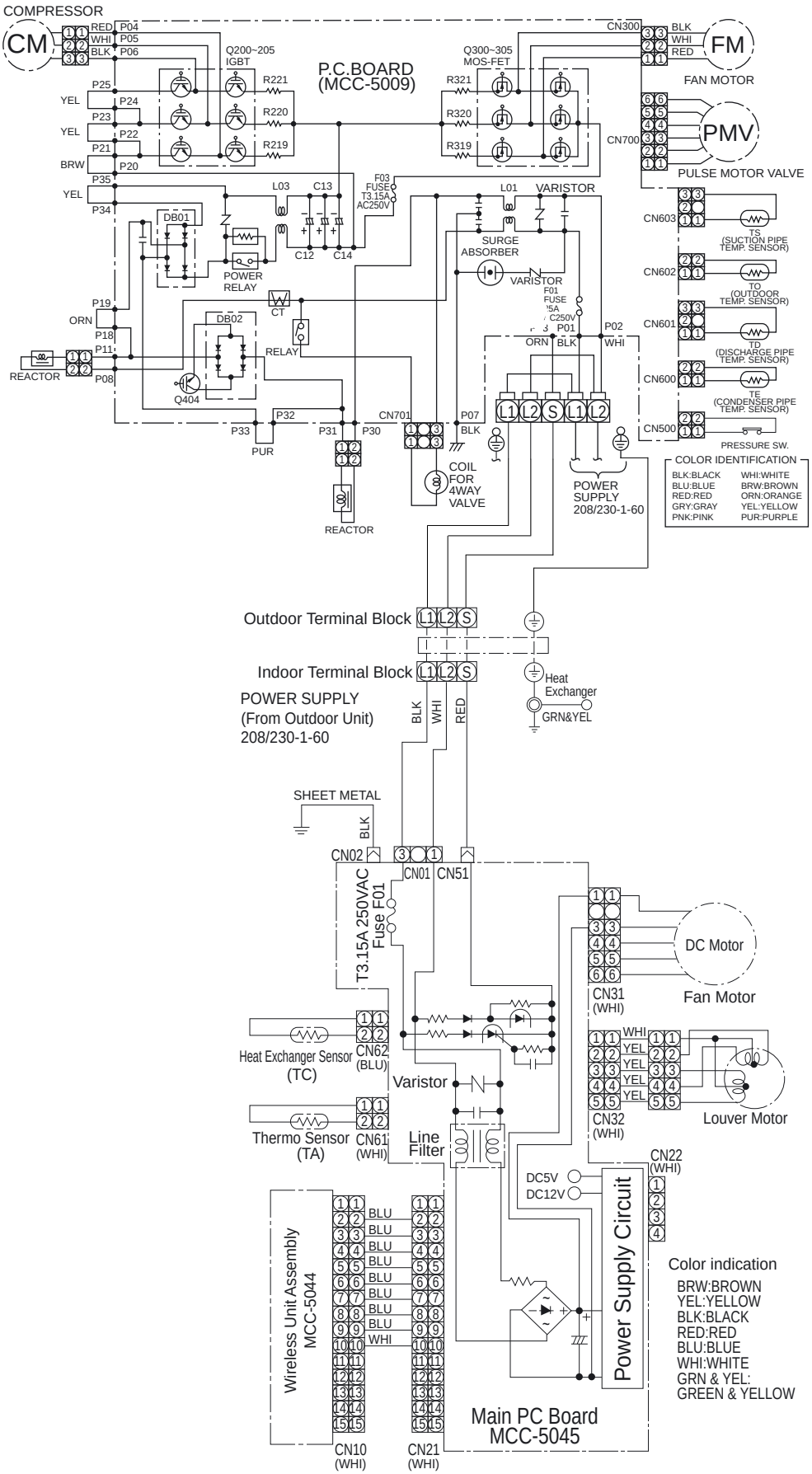


5. WIRING DIAGRAM

5-1. RAS-09LKV-UL / RAS-09LAV-UL



5-2. RAS-12LKV-UL /RAS-12LAV-UL



6. SPECIFICATIONS OF ELECTRICAL PARTS

6-1. Indoor Unit

No.	Parts name		Type	Specifications
1	Fan motor (for indoor)	RAS-09LKV-UL	AFS-220-20-4D	AC240V, 20W
		RAS-12LKV-UL	ICF-340U30-2	AC220V, 20W
2	Room temp. sensor (TA-sensor)		(–)	10kΩ at 25°C
3	Heat exchanger temp. sensor (TC-sensor)		(–)	10kΩ at 25°C
4	Louver motor		MP24Z3T	Output (Rated) 1W, 16 poles, DC12V

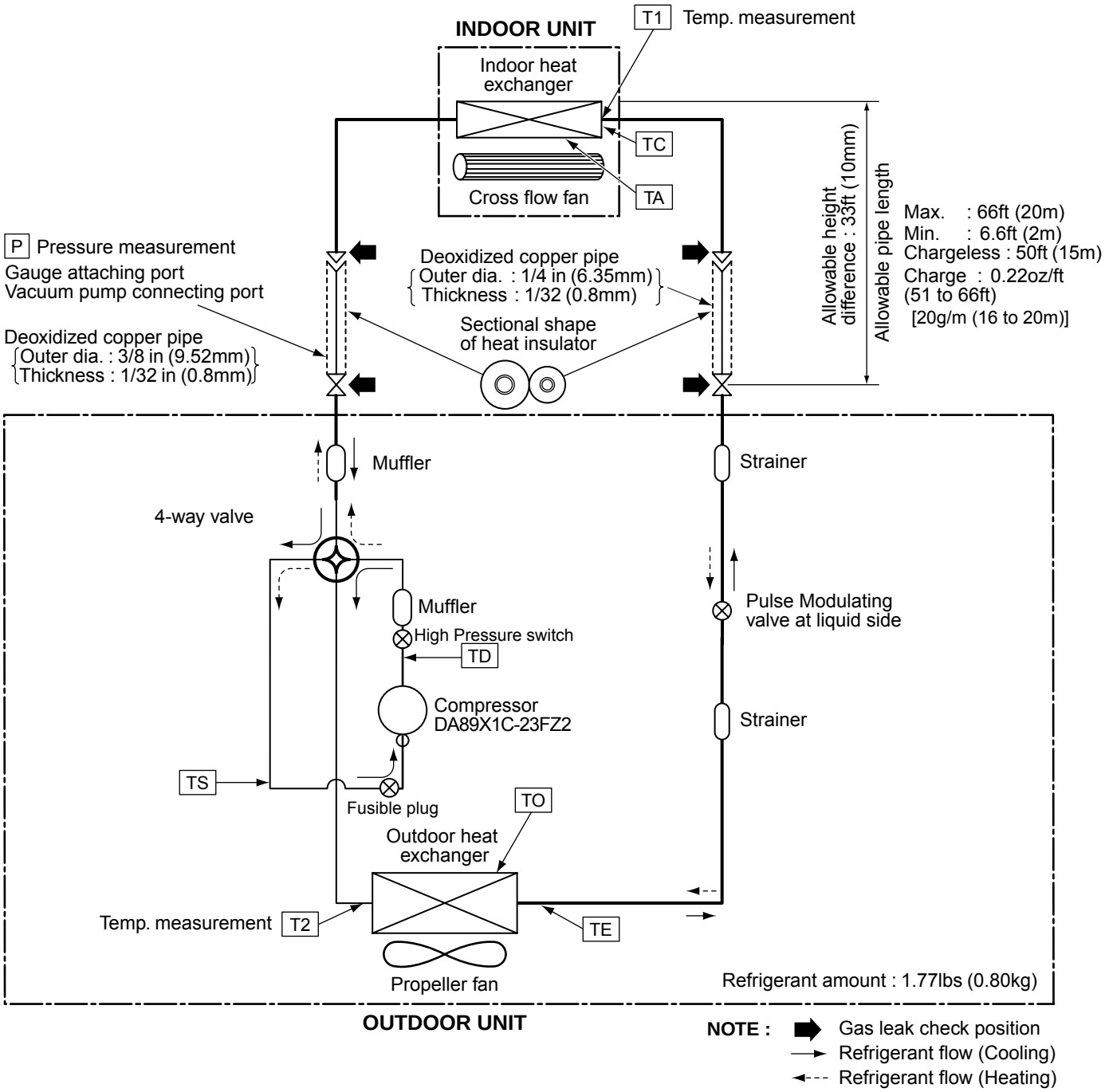
6-2. Outdoor Unit

No.	Parts name		Model name	Rating
1	Reactor		CH-57	L = 10mH, 16A
2	Outdoor fan motor		ICF-340UA40-2	DC340V, 40W
3	Suction temp. sensor (TS sensor)		(Inverter attached)	10kΩ (25°C)
4	Discharge temp. sensor (TD sensor)		(Inverter attached)	62kΩ (20°C)
5	Outside air temp. sensor (TO sensor)		(Inverter attached)	10kΩ (25°C)
6	Heat exchanger temp. sensor (TE sensor)		(Inverter attached)	10kΩ (25°C)
7	Terminal block (5P)		———	30A, AC600V
8	Compressor	RAS-09LAV-UL	DA89X1C-23FZ2	3-phases 4-poles 680W
		RAS-12LAV-UL	DA111A1F-20F2	3-phases 4-poles 750W
9	COIL FOR P.M.V.		CAM-MD 12TCTH-4	DC12V
10	Coil for 4-way valve		STF	
11	Pressure SW.		ACB-4UB82W	4.7 MPa

7. REFRIGERANT CYCLE DIAGRAM

7-1. Refrigerant Cycle Diagram

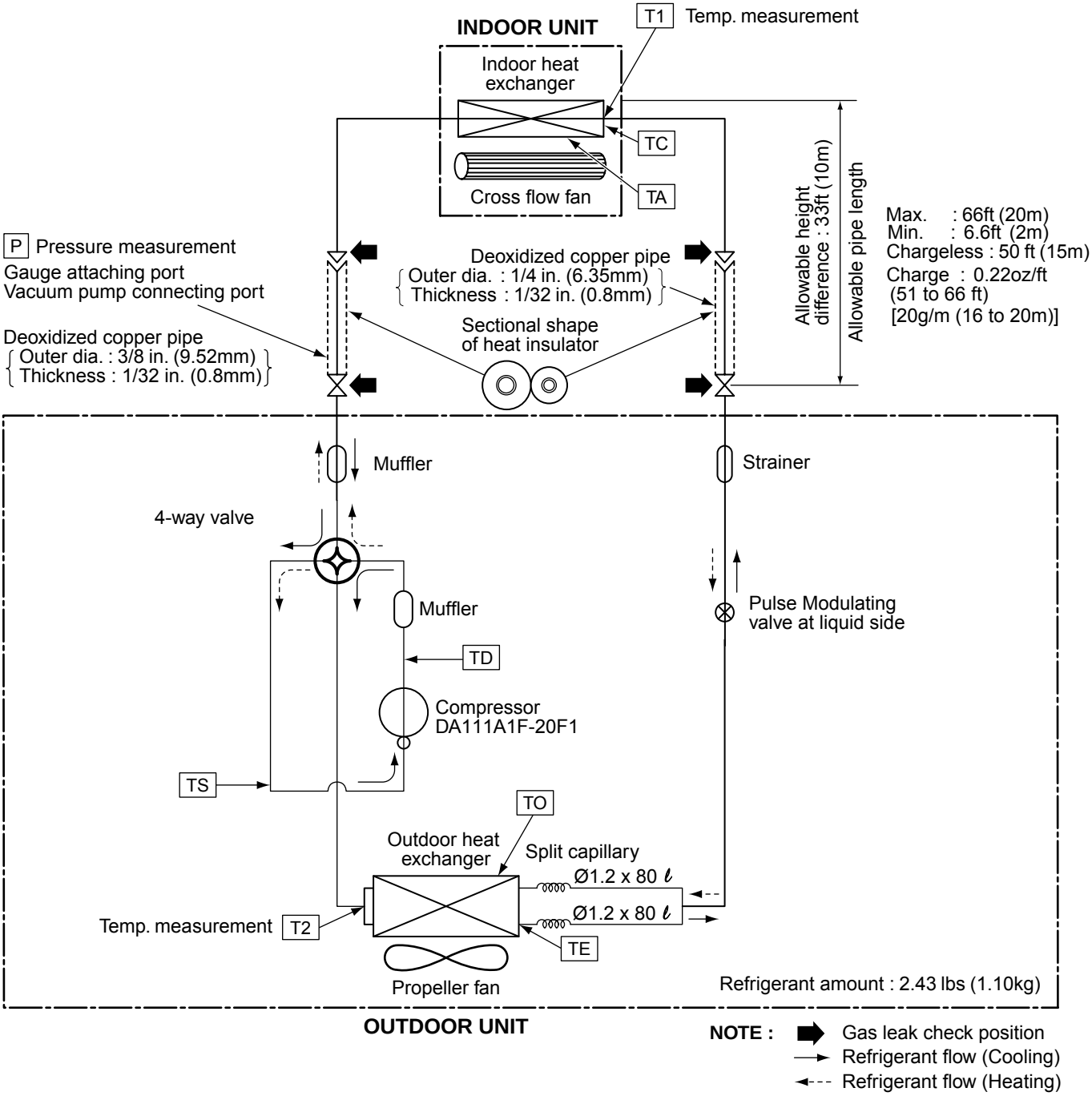
RAS-09LKV-UL / RAS-09LAV-UL



NOTE :

- The maximum pipe length of this air conditioner is 66ft (20 m). When the pipe length exceeds 50ft (15m), the additional charging of refrigerant, 0.22 oz/ft (20g/m) for the part of pipe exceeded 50ft (15m) is required. [(Max. 0.22 lbs (100g)]

RAS-12LKV-UL / RAS-12LAV-UL



NOTE :

- The maximum pipe length of this air conditioner is 66ft (15 m). When the pipe length exceeds 50ft (15m), the additional charging of refrigerant, 0.22 oz/ft (20g/m) for the part of pipe exceeded 15m is required. [Max. 0.22 lbs (100g)]

7-2. Operation Data

<Cooling>

Tempeature condition(°C)		Model name RAS-	Standard pressure	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		P Psia (MPa)	T1 °F (°C)	T2 °F (°C)			
80/67 (26.7/19.4)	98/75 (35/23.9)	09LKV-UL	137 to 160 (0.9 to 1.1)	54 to 57 (12 to 14)	99 to 102 (37 to 39)	High	High	60
		12LKV-UL	116 to 145 (0.8 to 1.0)	52 to 55 (11 to 13)	104 to 107 (42 to 44)	High	High	77

<Heating>

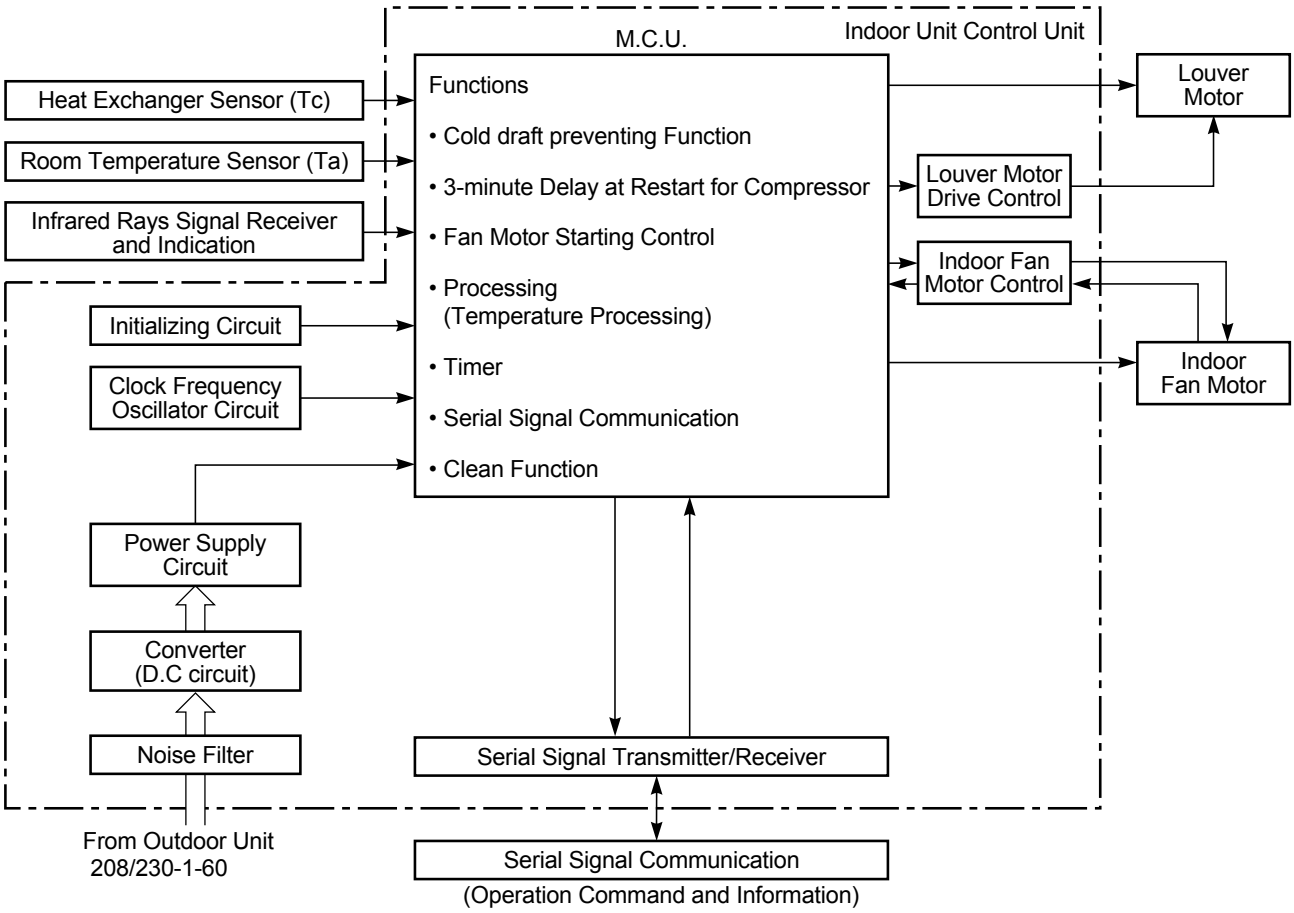
Tempeature condition(°C)		Model name RAS-	Standard pressure	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		P Psia (MPa)	T1 °F (°C)	T2 °F (°C)			
70/60 (21.1/15.6)	47/43 (8.3/6.1)	09LKV-UL	363 to 392 (2.5 to 2.7)	102 to 105 (39 to 41)	32 to 37 (0 to 3)	High	High	62
		12LKV-UL	377 to 406 (2.6 to 2.8)	106 to 106 (41 to 43)	32 to 36 (0 to 2)	High	High	64

NOTES :

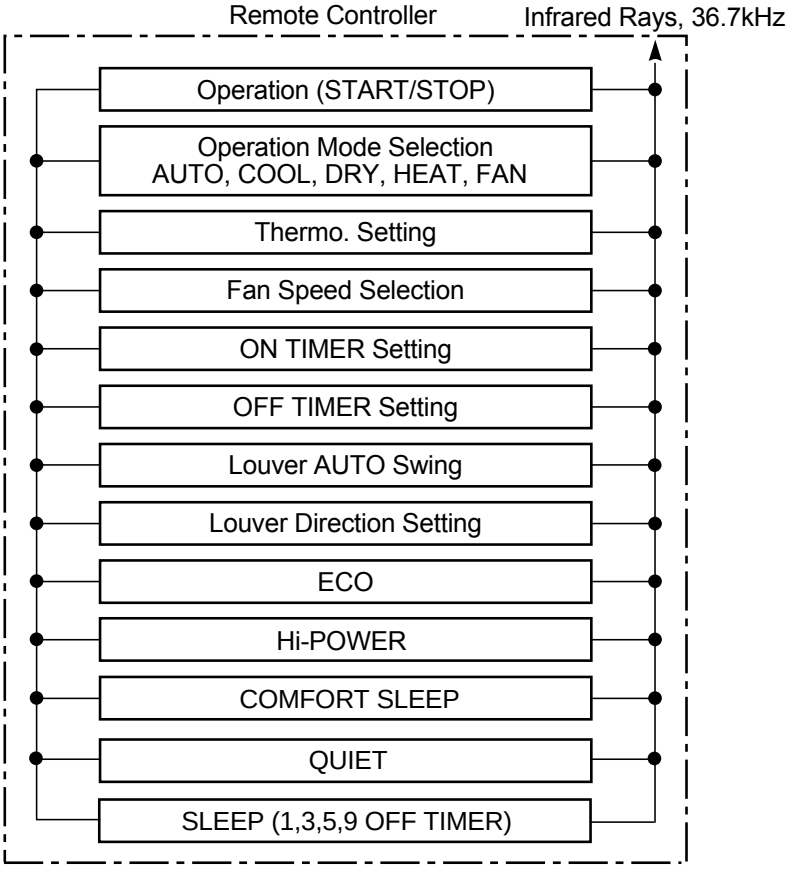
1. Measure surface temperature of heat exchanger pipe around center of heat exchaner path U bent. (Thermistor themometer)
2. Connecting piping condition : 16 ft (5m)

8. CONTROL BLOCK DIAGRAM

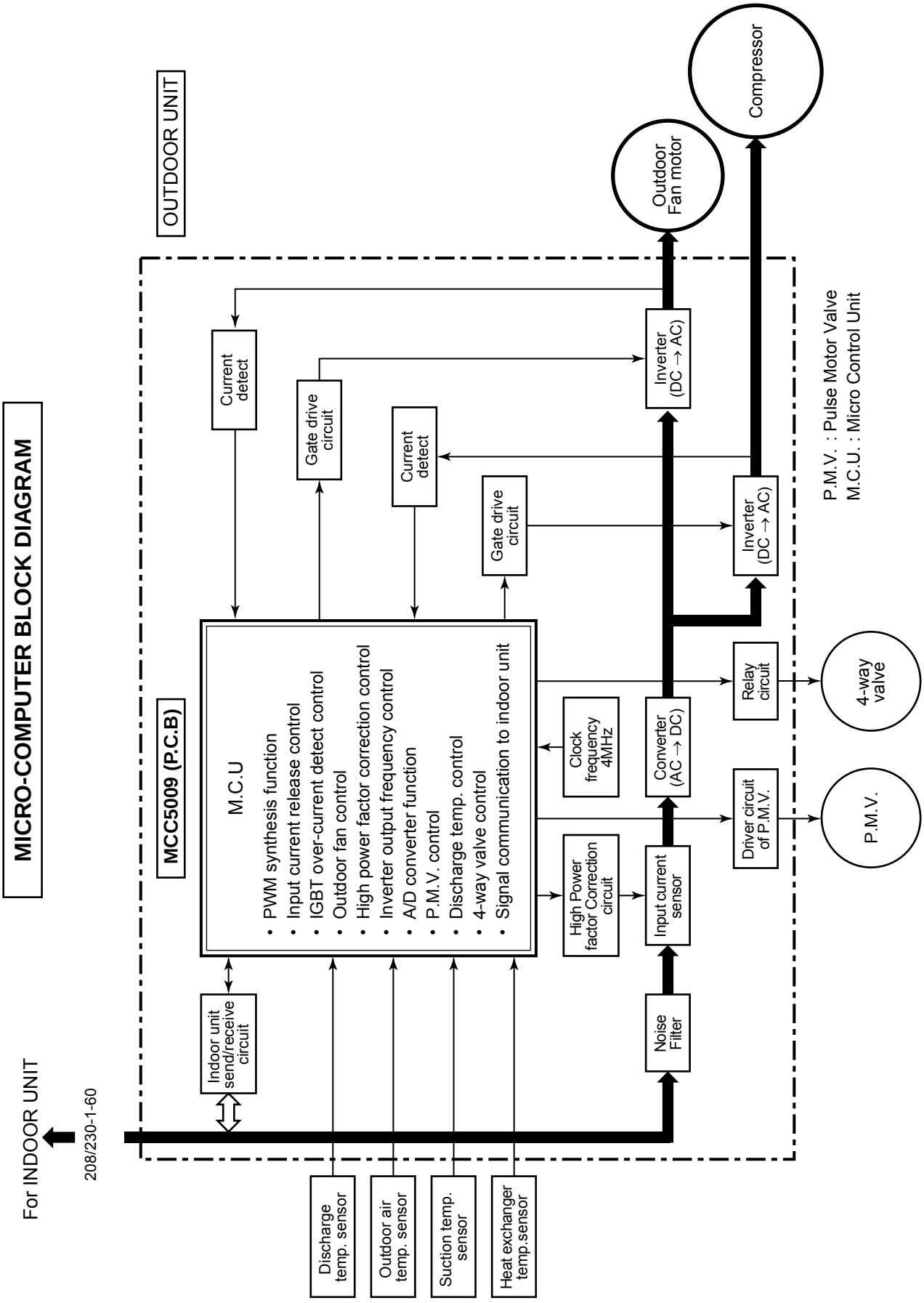
8-1. Indoor Unit



REMOTE CONTROLLER



8-2. Outdoor Unit (Inverter Assembly)



9. OPERATION DESCRIPTION

9-1. Outline of Air Conditioner Control

This air conditioner is a capacity-variable type air conditioner, which uses AC or DC motor for the indoor for motor and the outdoor fan motor. And the capacity-proportional control compressor which can change the motor speed in the range from 11 to 96 rps is mounted. The DC motor drive circuit is mounted to the indoor unit. The compressor and the inverter to control fan motor are mounted to the outdoor unit.

The entire air conditioner is mainly controlled by the indoor unit controller.

The indoor unit controller drives the indoor fan motor based upon command sent from the remote controller, and transfers the operation command to the outdoor unit controller.

The outdoor unit controller receives operation command from the indoor unit side, and controls the outdoor fan and the pulse Modulating valve. (P.M.V) Besides, detecting revolution position of the compressor motor, the outdoor unit controller controls speed of the compressor motor by controlling output voltage of the inverter and switching timing of the supply power (current transfer timing) so that motors drive according to the operation command.
And then, the outdoor unit controller transfers reversely the operating status information of the outdoor unit to control the indoor unit controller.

As the compressor adopts four-pole brushless DC motor, the frequency of the supply power from inverter to compressor is two-times cycles of the actual number of revolution.

1. Role of indoor unit controller

The indoor unit controller judges the operation commands from the remote controller and assumes the following functions.

- Judgment of suction air temperature of the indoor heat exchanger by using the indoor temp. sensor. (TA sensor)
- Judgment of the indoor heat exchanger temperature by using heat exchanger sensor (TC sensor) (Prevent-freezing control, etc.)
- Louver motor control
- Indoor fan motor operation control
- LED (Light Emitting Diode) display control
- Transferring of operation command signal (Serial signal) to the outdoor unit
- Reception of information of operation status (Serial signal including outside temp. data) to the outdoor unit and judgment/display of error
- Air purifier operation control

2. Role of outdoor unit controller

Receiving the operation command signal (Serial signal) from the indoor unit controller, the outdoor unit performs its role.

- Compressor operation control
- Operation control of outdoor fan motor
- P.M.V. control
- 4-way valve control

} Operations followed to judgment of serial signal from indoor side.

- Detection of inverter input current and current release operation
- Over-current detection and prevention operation to IGBT module (Compressor stop function)
- Compressor and outdoor fan stop function when serial signal is off (when the serial signal does not reach the board assembly of outdoor control by trouble of the signal system)
- Transferring of operation information (Serial signal) from outdoor unit controller to indoor unit controller
- Detection of outdoor temperature and operation revolution control
- Defrost control in heating operation (Temp. measurement by outdoor heat exchanger and control for 4-way valve and outdoor fan)

3. Contents of operation command signal (Serial signal) from indoor unit controller to outdoor unit controller

The following three types of signals are sent from the indoor unit controller.

- Operation mode set on the remote controller
- Compressor revolution command signal defined by indoor temperature and set temperature (Correction along with variation of room temperature and correction of indoor heat exchanger temperature are added.)
- Temperature of indoor heat exchanger
- For these signals ([Operation mode] and [Compressor revolution] indoor heat exchanger temperature), the outdoor unit controller monitors the input current to the inverter, and performs the followed operation within the range that current does not exceed the allowable value.

4. Contents of operation command signal (Serial signal) from outdoor unit controller to indoor unit controller

The following signals are sent from the outdoor unit controller.

- The current operation mode
- The current compressor revolution
- Outdoor temperature
- Existence of protective circuit operation

  For transferring of these signals, the indoor unit controller monitors the contents of signals, and judges existence of trouble occurrence.

  Contents of judgment are described below.
  - Whether distinction of the current operation status meets to the operation command signal
  - Whether protective circuit operates

    When no signal is received from the outdoor unit controller, it is assumed as a trouble.

9-2. Operation Description

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   1. Operation control 28
   2. Cooling/Heating operation 29
   3. AUTO operation 29
   4. DRY operation 29
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4. Capacity control 33
5. Current release control 33
6. Release protective control by temperature of indoor heat exchanger 34
7. Defrost control (Only in heating operation) 35
8. Louver control 36
   1) Louver position 36
   2) Air direction adjustment 36
   3) Swing 36
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11. Discharge temperature control 38
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9-3-3. Power Failure During Timer Operation 46

9-4. Remote Controller and Its Fuctions

9-4-1. Parts Name of Remote Controller 47

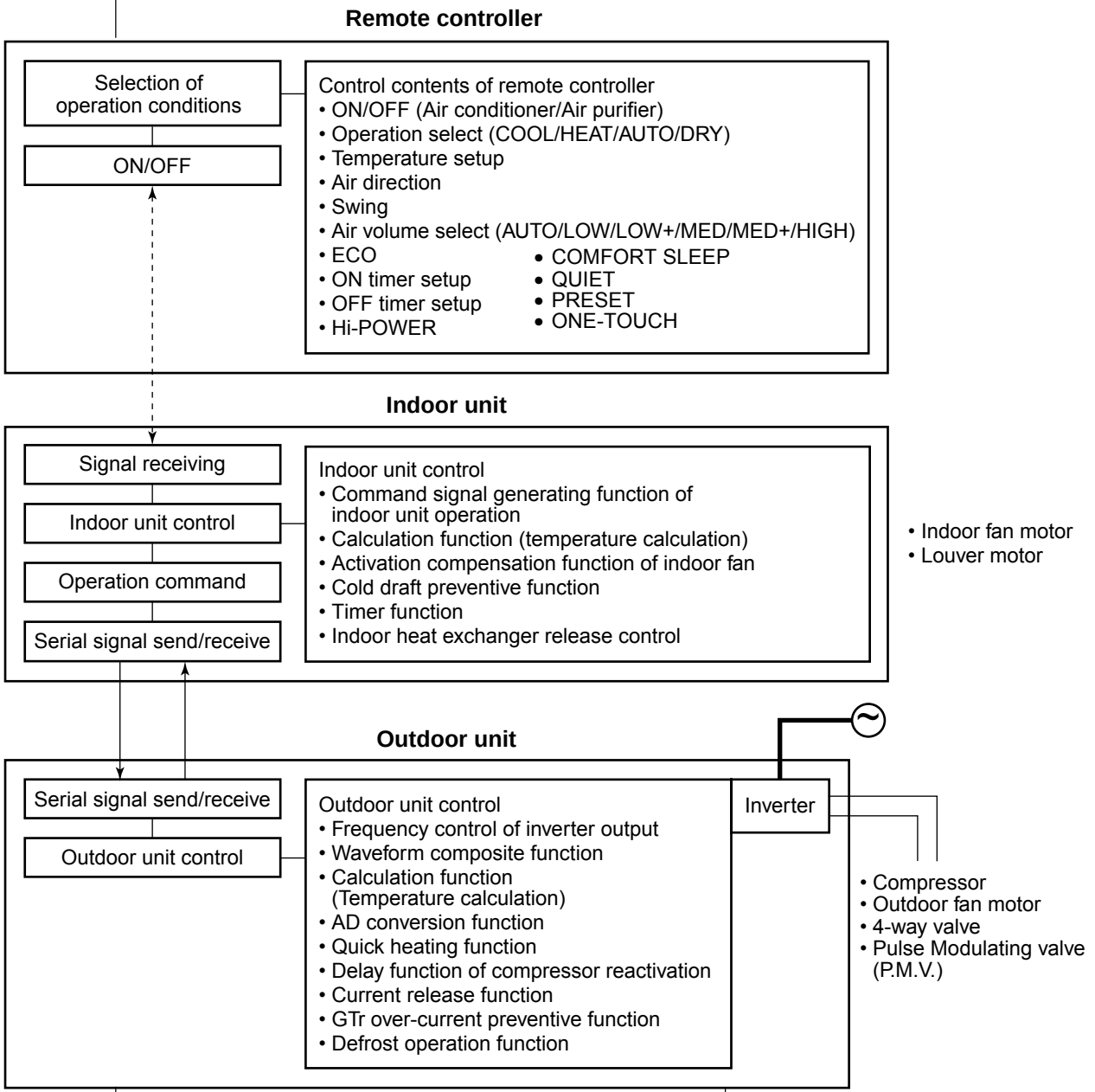
9-4-2. Operation of remote control 47

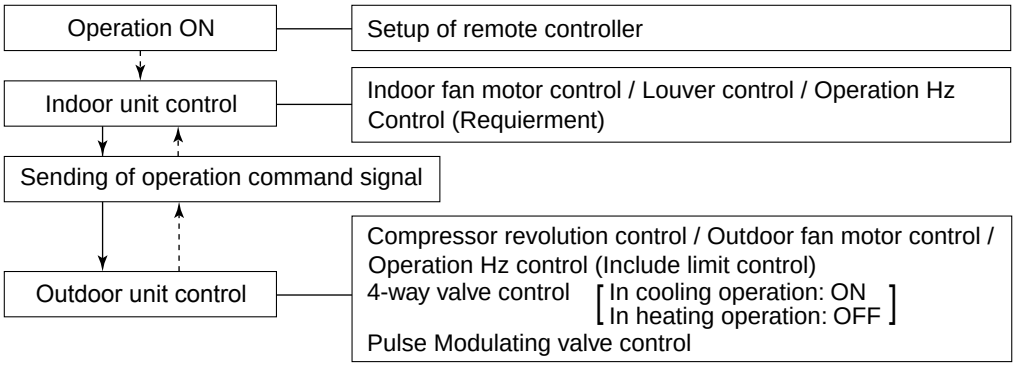
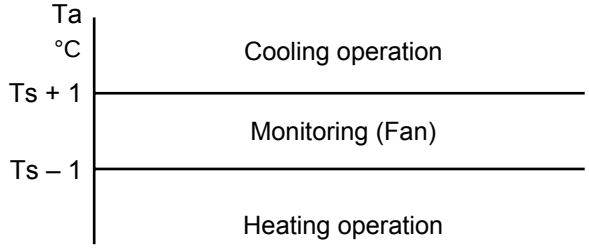
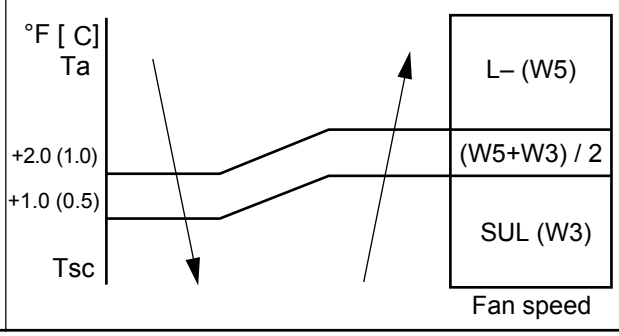
9-4-3. Name and Functions of Indications on Remote Controller 50

Item	Operation flow and applicable data, etc.	Description
1. Basic operation	**1. Operation control**	

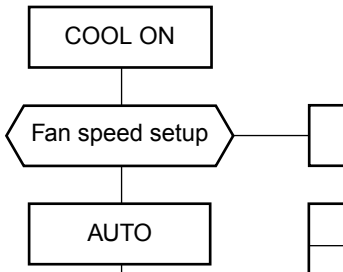
Receiving the user's operation condition setup, the operation statuses of indoor/outdoor units are controlled.

1) The operation conditions are selected by the remote controller as shown in the below.
2) A signal is sent by ON button of the remote controller.
3) The signal is received by a sensor of the indoor unit and processed by the indoor controllers as shown in the below.
4) The indoor controller controls the indoor fan motor and louver motor.
5) The indoor controller sends the operation command to the outdoor controller, and sends/receives the control status with a serial signal.
6) The outdoor controller controls the operation as shown in the left, and also controls the compressor, outdoor fan motor, 4-way valve and pulse Modulating valve.



Item	Operation flow and applicable data, etc.	Description
1. Basic operation	**2. Cooling/Heating operation** The operations are performed in the following parts by controls according to cooling/heating conditions. 1) Receiving the operation ON signal of the remote controller, the cooling or heating operation signal starts being transferred form the indoor controller to the outdoor unit. 2) At the indoor unit side, the indoor fan is operated according to the contents of "**2. Indoor fan motor control**" and the louver according to the contents of "**9. Louver control**", respectively. 3) The outdoor unit controls the outdoor fan motor, compressor, pulse Modulating valve and 4-way valve according to the operation signal sent from the indoor unit.  	
	3. AUTO operation Selection of operation mode As shown in the following figure, the operation starts by selecting automatically the status of room temperature (Ta) when starting AUTO operation. *1. When reselecting the operation mode, the fan speed is controlled by the previous operation mode.  	1) Detects the room temperature (Ta) when the operation started. 2) Selects an operation mode from Ta in the left figure. 3) Fan operation continues until an operation mode is selected. 4) When AUTO operation has started within 2 hours after heating operation stopped and if the room temperature is 68°F (20°C) or more, the fan operation is performed with "Super Ultra LOW" mode for 3 minutes. Then, select an operation mode. 5) In AUTO mode, either cooling or heating operation will be selected. When room temperature reach set temperature commpressor will stop. In case that the compressor stops for 15 minutes, the AUTO mode will reselect cooling or heating operation.
	4. DRY operation DRY operation is performed according to the difference between room temperature and the setup temperature as shown below. In DRY operation, fan speed is controlled in order to prevent lowering of the room temperature and to avoid air flow from blowing directly to persons.  	1) Detects the room temperature (Ta) when the DRY operation started. 2) Starts operation under conditions in the left figure according to the temperature difference between the room temperature and the setup temperature (Tsc). Setup temperature (Tsc) = Set temperature on remote controller (Ts) + 0~1.0°C (0 to 2°F) 3) When the room temperature is lower 2°F (1°C) or less than the setup temperature, turn off the compressor.

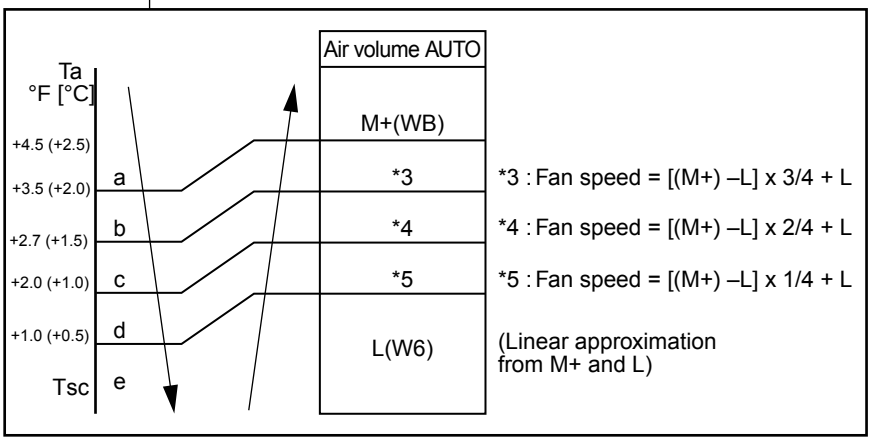
Item	Operation flow and applicable data, etc.	Description
2. Indoor fan motor control	**<In cooling operation>** (This operation controls the fan speed at indoor unit side.) The indoor fan (cross flow fan) is operated by the phase-control induction motor. The fan rotates in 5 stages in MANUAL mode, and in 5 stages in AUTO mode, respectively. (Table 1)	



(Fig. 1)

Indication	Fan speed
L	W6
L+	(L + M) / 2
M	W9
M+	(M + H) / 2
H	WC

(Fig. 2)



*** Symbols**

UH	: Ultra High
H	: High
M+	: Medium+
M	: Medium
L+	: Low+
L	: Low
L-	: Low–
UL	: Ultra Low
SUL	: Super Ultra Low

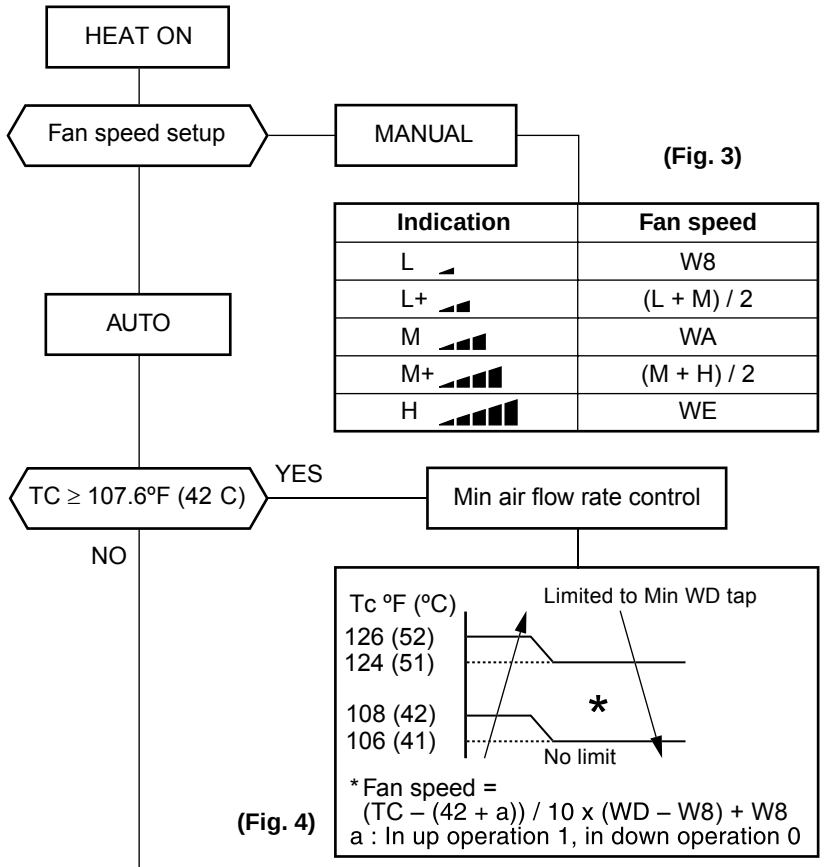
* The values of fan speed and air flow volume indicate on the table are measured when the louver is inclined downward. Fan speed and air flow volume broadly vary with position of louver.

1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 1.
2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 2 and Table 1 according to the setup temperature and room temperature.

(Table 1) Indoor fan air flow rate

Fan speed level	COOL	HEAT	DRY	RAS-09LKV-UL		RAS-12LKV-UL	
				Fan speed (rpm)	Air flow rate cfm (m3/h)	Fan speed (rpm)	Air flow rate cfm (m3/h)
WF		UH		1210	336 (571)	1510	433 (735)
WE		H		1210	336 (571)	1510	433 (735)
WD	UH	M+	UH	1170	321 (546)	1480	422 (717)
WC	H		H	1120	303 (515)	1430	404 (686)
WB	M+		M+	1040	274 (465)	1280	350 (594)
WA			M	1000	248 (421)	1220	328 (557)
W9	M	L+		960	235 (400)	1150	302 (514)
W8		L		870	200 (340)	1000	248 (421)
W7	L+	L-	L+	850	194 (330)	980	241 (409)
W6	L		L	760	159 (270)	920	219 (372)
W5	L-	UL	L-	760	159 (270)	900	212 (360)
W4	UL		UL	700	141 (240)	840	190 (323)
W3	SUL		SUL	650	118 (200)	770	165 (280)
W2		SUL		500	65 (110)	620	110 (187)
W1				500	65 (110)	520	74 (126)

Item	Operation flow and applicable data, etc.	Description
2. Indoor fan motor control	**<In heating operation>**	1) When setting the fan speed to L, L+, M, M+ or H on the remote controller, the operation is performed with the constant speed shown in Fig. 3 and Table 1. 2) When setting the fan speed to AUTO on the remote controller, revolution of the fan motor is controlled to the fan speed level shown in Fig. 5 according to the set temperature and room temperature. 3) Min air flow rate is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 4 for prevent high temperature of heat exchanger. 4) Cold draft prevention, the fan speed is controlled by temperature of the indoor heat exchanger (Tc) as shown in Fig. 6 for keep warm temperature of air flow. 5) In order to prevent Cold draft when compressor stop during heating operation. Then louver will move to upper position and fan speed will reduce or off.

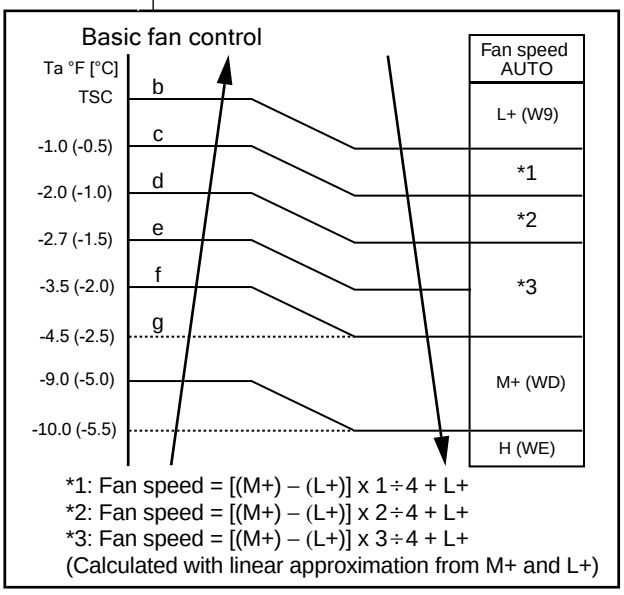


(Fig. 3)

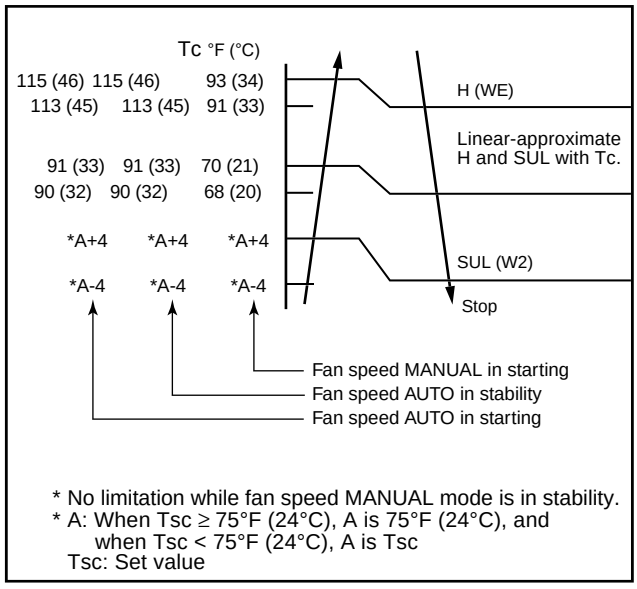
Indication	Fan speed
L	W8
L+	(L + M) / 2
M	WA
M+	(M + H) / 2
H	WE

(Fig. 4)

Cold draft preventive control



(Fig. 5)

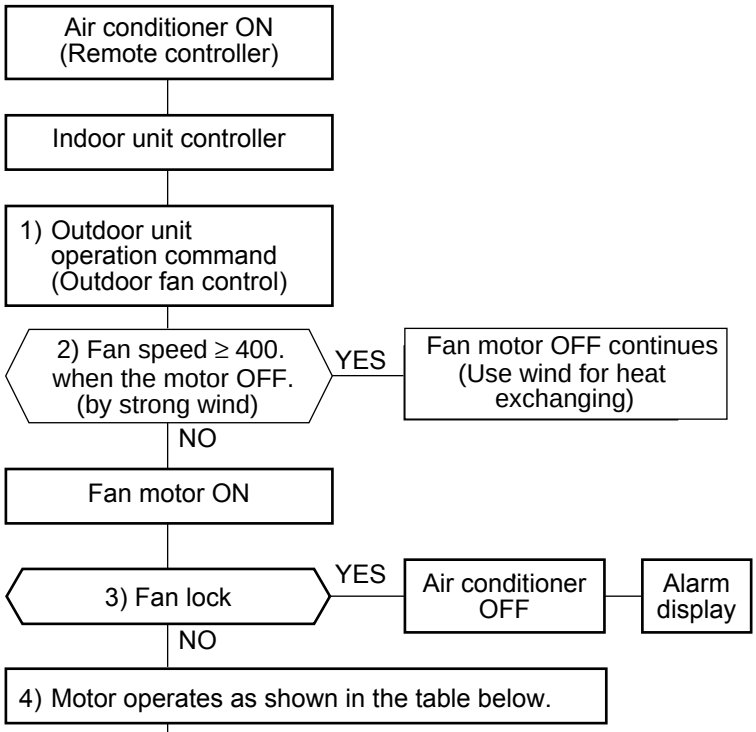


(Fig. 6)

[In starting and in stability]

	In starting	In stability
FAN AUTO	• Until 12 minutes passed after operation start • When 12 to 25 minutes passed after operation start and room temp. is 5.4°F (3°C) or lower than set temp.	• When 12 to 25 minutes passed after operation start and room temp. is higher than [set temp. -5.4ºF (–3°C)] • When 25 minutes or more passed after operation start
FAN Manual	• Room temp. < Set temp. -7°F (– 4°C)	• Room temp. ≥ Set temp. -6.3°F (–3.5°C)

Item	Operation flow and applicable data, etc.	Description
3. Outdoor fan motor control	The blowing air volume at the outdoor unit side is controlled. Receiving the operation command from the controller of indoor unit, the controller of outdoor unit controls fan speed. * For the fan motor, a DC motor with non-stage variable speed system is used. However, it is limited to 8 stages for reasons of controlling.	1) The operation command sent from the remote controller is processed by the indoor unit controller and transferred to the controller of the outdoor unit. 2) When strong wind blows at outdoor side, the operation of air conditioner continues with the fan motor stopped. 3) Whether the fan is locked or not is detected, and the operation of air conditioner stops and an alarm is displayed if the fan is locked. 4) According to each operation mode, by the conditions of outdoor temperature (To) and compressor revolution, the speed of the outdoor fan shown in the table is selected.



In cooling operation

Compressor speed (rps)		~ 13.8		~ 31.7		32.3 ~ MAX	
		MIN	MAX	MIN	MAX	MIN	MAX
To	To ≥ 100°F (38°C)	f 2	f 3	f C	f D	f E	f F
	To ≥ 82°F (28°C)	f 2	f 3	f A	f C	f D	f F
	To ≥ 59°F (15°C)	f 2	f 3	f 7	f A	f 9	f C
	To ≥ 42°F (5.5°C)	f 1	f 3	f 2	f 5	f 4	f 7
	To ≥ 32°F (0°C)	f 1	f 1	f 1	f 2	f 2	f 4
	To < 32°F (0°C)	f 0	f 0	f 0	f 1	f 1	f 2
During ECO mode	To ≥ 100°F (38°C)	f 2	f 3	f B	f C	f C	f D
	To ≥ 100°F (38°C)	f 2	f 3	f 2	f 3	f B	f C
When To is abnormal		f D	f F	f D	f F	f D	f F

In Heating operation

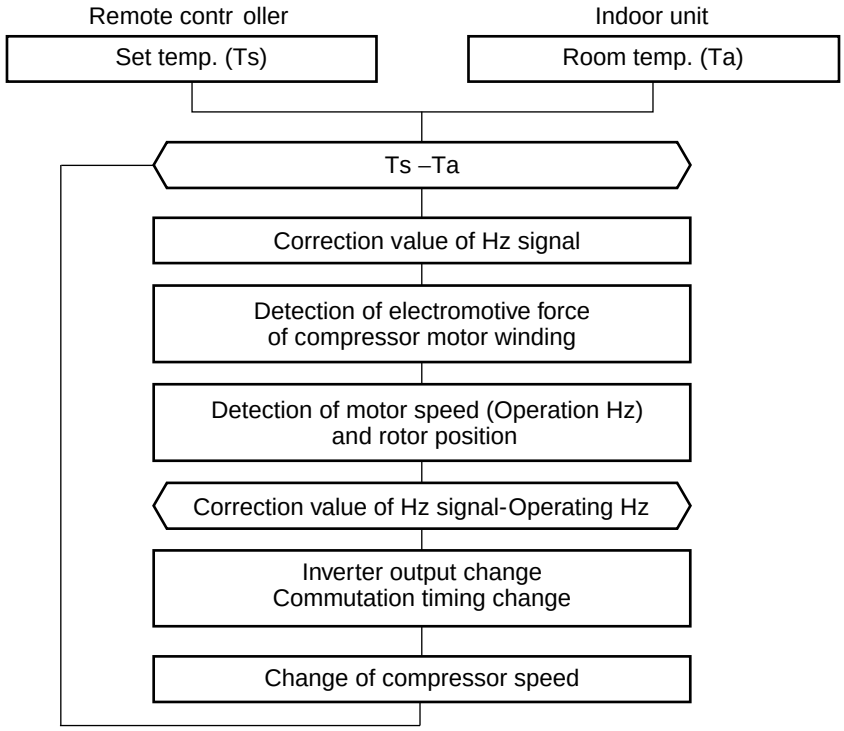
Compressor speed (rps)		~16.8	~47.9	48.5 ~ MAX
To	To ≥ 50°F (10°C)	f 3	f 8	f 9
	To ≥ 42°F (15°C)	f 3	f 9	f A
	To ≥ 22°F (-5°C)	f 8	f A	f D
	To < 22°F (-5°C)	f B	f C	f D
During ECO mode	To ≥ 50°F (10°C)	f 3	f 3	f 6
	To ≥ 42°F (15°C)	f 3	f 3	f 8
	To ≥ 22°F (-5°C)	f 5	f 9	f 9
	To < 22°F (-5°C)	f 7	f A	f B
When To is abnormal		f A	f B	f D

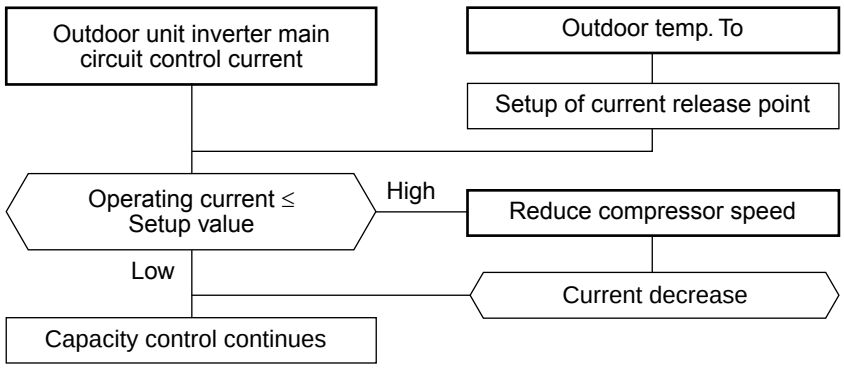
Outdoor fan speed (rpm)

Tap	RAS-09LAV-UL	RAS-12LAV-UL
f 0	0	0
f 1	200	200
f 2	300	300
f 3	370	370
f 4	440	440
f 5	440	440
f 6	500	500
f 7	550	550
f 8	600	600

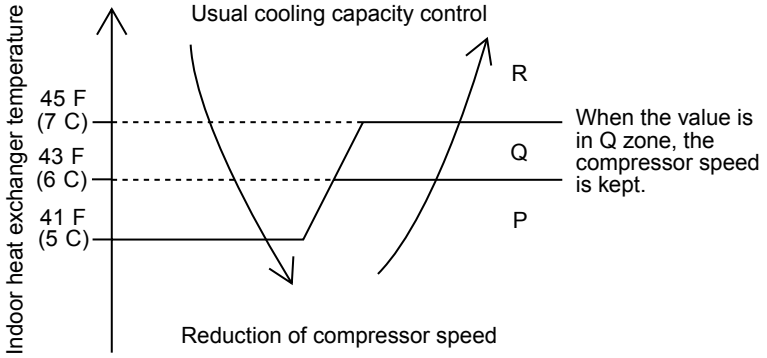
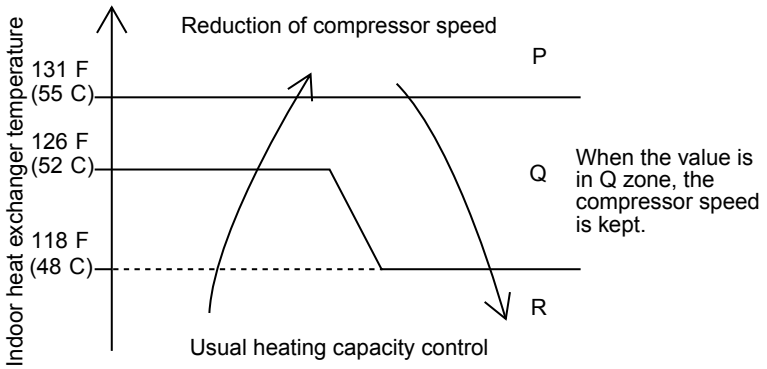
Tap	RAS-09LAV-UL	RAS-12LAV-UL
f 9	600	650
f A	600	700
f B	650	700
f C	700	800
f D	700	800
f E	700	800
f F	700	900

Item	Operation flow and applicable data, etc.	Description
4. Capacity control	The cooling or heating capacity depending on the load is adjusted. According to difference between the setup value of temperature and the room temperature, the capacity is adjusted by the compressor revolution.	1) The difference between set temperature on remote controller (Ts) and room temperature (Ta) is calculated. 2) According to the temperature difference, the correction value of Hz signal which determines the compressor speed is set up. 3) The rotating position and speed of the motor are detected by the electromotive force occurred on the motor winding with operation of the compressor. 4) According to the difference resulted from comparison of the correction value of Hz signal with the present operation Hz, the inverter output and the commutation timing are varied. 5) Change the compressor motor speed by outputting power to the compressor. * The contents of control operation are same in cooling operation and heating operation
5. Current release control	This function prevents troubles on the electronic parts of the compressor driving inverter. This function also controls drive circuit of the compressor speed so that electric power of the compressor drive circuit does not exceed the specified value.	1) The input current of the outdoor unit is detected in the inverter section of the outdoor unit. 2) According to the detected outdoor temperature, the specified value of the current is selected. 3) Whether the current value exceeds the specified value or not is judged. 4) If the current value exceeds the specified value, this function reduces the compressor speed and controls speed up to the closest one commanded from the indoor unit within the range which does not exceed the specified value.

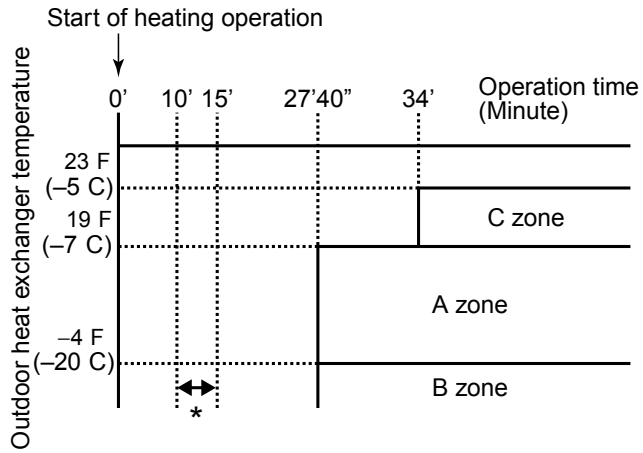




Outdoor temp.		Cooling current release value		Heating current release value	
		RAS-09LAV-UL	RAS-12LAV-UL	RAS-09LAV-UL	RAS-12LAV-UL
113ºF (45ºC)		3.97A	4.27A	6.30A	7.72A
104ºF (40ºC)	111ºF (44ºC)	4.35A	4.88A		
61ºF (16ºC)	102ºF (39ºC)	6.30A	8.47A		
52ºF (11ºC)	60ºF (15.5ºC)				
	51ºF (10.5ºC)			6.30A	8.10A
				6.30A	8.47A

Item	Operation flow and applicable data, etc.	Description
6. Release protective control by temperature of indoor heat exchanger	**<In cooling/dry operation>** (Prevent-freezing control for indoor heat exchanger) In cooling/dry operation, the sensor of indoor heat exchanger detects evaporation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.  	1) When temperature of the indoor heat exchanger drops below 41°F (5°C), the compressor speed is reduced. (P zone) 2) When temperature of the indoor heat exchanger rises in the range from 43°F (6°C) to under 45°F (7°C), the compressor speed is kept. (Q zone) 3) When temperature of the indoor heat exchanger rises to 45°F (7°C) or higher, the capacity control operation returns to the usual control in cooling operation. (R zone)
	<In heating operation> (Prevent-overpressure control for refrigerating cycle) In heating operation, the sensor of indoor heat exchanger detects condensation temperature and controls the compressor speed so that temperature of the heat exchanger does not exceed the specified value.  	1) When temperature of the indoor heat exchanger rises in the range from 126°F (52°C) to 131°F (55°C), compressor speed is kept. (Q zone) When temperature of the indoor heat exchanger drops in the range from 118°F (48°C) to under 131°F (55°C) the compressor speed is kept. (Q zone) 2) When temperature of the indoor heat exchanger rises to 131°F (55°C) or higher, the compressor speed is reduced. (P zone) 3) When temperature of the indoor heat exchanger does not rise to 126°F (52°C), or when it drops below to 118°F (48°C), the capacity control operation returns to the usual control in heating operation. (R zone)

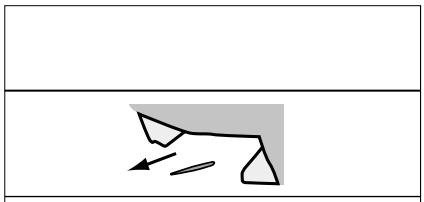
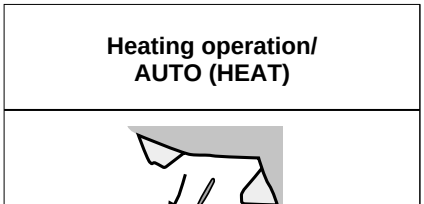
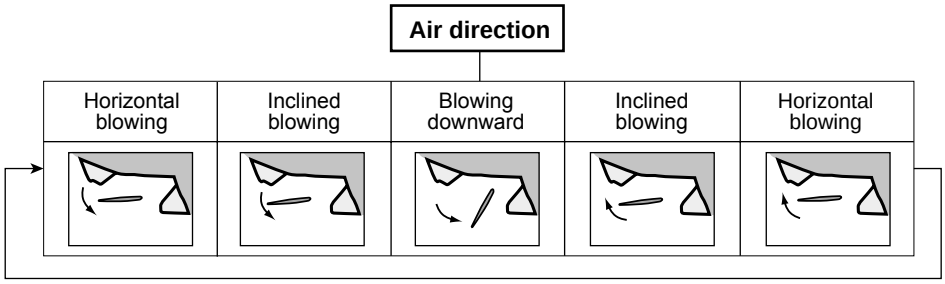
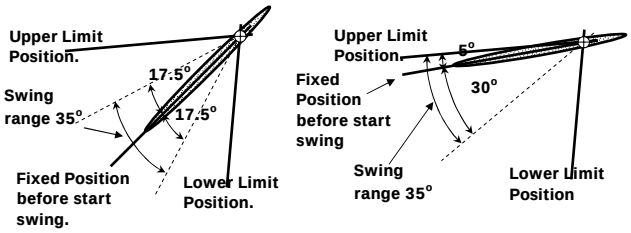
Item	Operation flow and applicable data, etc.	Description
7. Defrost control (Only in heating operation)	(This function removes frost adhered to the outdoor heat exchanger.) The temperature sensor of the outdoor heat exchanger (Te sensor) judges the frosting status of the outdoor heat exchanger and the defrost operation is performed with 4-way valve reverse defrost system.	The necessity of defrost operation is detected by the outdoor heat exchanger temperature. The conditions to detect the necessity of defrost operation differ in A, B, or C zone each. (Table 1) **<Defrost operation>** • Defrost operation in A to C zones 1) Stop operation of the compressor for 20 seconds. 2) Invert (ON) 4-way valve 10 seconds after stop of the compressor. 3) The outdoor fan stops at the same time when the compressor stops. 4) When temperature of the indoor heat exchanger becomes 100°F (38°C) or lower, stop the indoor fan. **<Finish of defrost operation>** • Returning conditions from defrost operation to heating operation 1) Temperature of outdoor heat exchanger rises to 46°F (8°C) or higher. 2) Temperature of outdoor heat exchanger is kept at 41°F (5°C) or higher for 80 seconds. 3) Defrost operation continues for 15 minutes. **<Returning from defrost operation>** 1) Stop operation of the compressor for approx. 50 seconds. 2) Invert (OFF) 4-way valve approx. 40 seconds after stop of the compressor. 3) The outdoor fan starts rotating at the same time when the compressor starts.



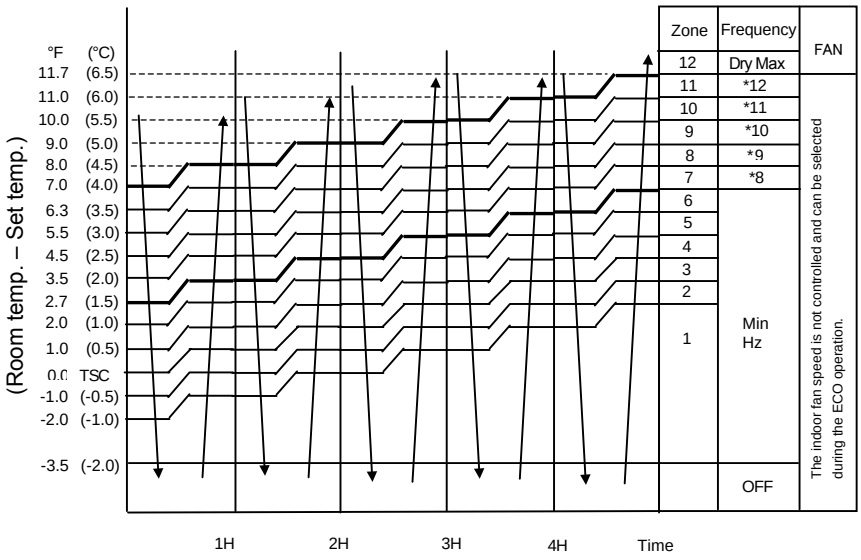
* The minimum value of Te sensor 10 to 15 minutes after start of operation is stored in memory as Te0.

Table 1

A zone	When Te0 - TE ≥ 4.5°F (2.5°C) continued for 2 minutes in A zone, defrost operation starts.
B zone	When the operation continued for 2 minutes in B zone, defrost operation starts.
C zone	When Te0 - TE ≥ 5.4°F (3°C) continued for 2 minutes in C zone, defrost operation starts.

Item	Operation flow and applicable data, etc.	Description
8. Louver control 1) Louver position	This function controls the air direction of the indoor unit. • The position is automatically controlled according to the operation mode (COOL/HEAT). • The set louver position is stored in memory by the microcomputer, and the louver returns to the stored position when the next operation is performed. (Cooling/Heating memory position) The angle of the louver is indicated as the louver closes fully is 0°. 1) Louver position in cooling operation  Initial setting of "Cooling storage position" Louver : Directs downward (35.3°) **2) Louver position in heating operation**  **Heating operation/ AUTO (HEAT)** Initial setting of "Heating storage position" Louver : Directs downward (80.5)	
2) Air direction adjustment	 **Air direction** Horizontal blowing / Inclined blowing / Blowing downward / Inclined blowing / Horizontal blowing	• The louver position can be arbitrarily set up by pressing [FIX] button.
3) Swing	• Swing operation is perfor in range 35° with the Fixed position as the center. • If the swing range exceeded either upper or lower limit position, swing operation is perfomed in range 35° from the limit.  Upper Limit Position. / 17.5° / Swing range 35° / 17.5° / Fixed Position before start swing. / Lower Limit Position. Upper Limit Position. / 5° / Fixed Position before start swing / 30° / Swing range 35° / Lower Limit Position	• Swing When pressing [SWING] button during operation, the louver starts swinging.

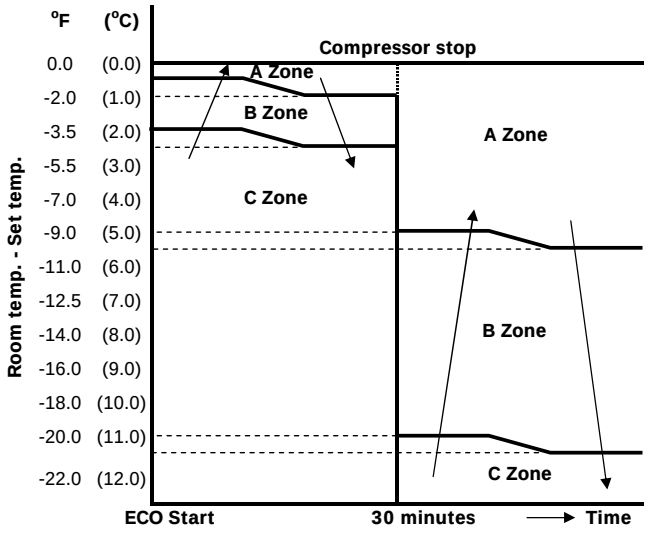
Item	Operation flow and applicable data, etc.	Description
9. ECO operation	When pressing [ECO] button on the remote controller, a Economic operation is performed. **<Cooling operation>** This function operates the air conditioner with the difference between the set and the room temperature as shown in the following figure.	**<Cooling operation>** 1) The control target temperature increase 1.0°F (0.5ºC) per hour up to 3.5°F (2°C) starting from the set temperature when ECONO has been received. 2) The indoor fan speed is depend on presetting and can change every speed after setting ECO operation. 3) The compressor speed is controlled as shown in the left figure.



* 12 (DRY max - COOL min) /6 x 5 + COOL min
* 11 (DRY max - COOL min) /6 x 4 + COOL min
* 10 (DRY max - COOL min) /6 x 3 + COOL min
* 9 (DRY max - COOL min) /6 x 2 + COOL min
* 8 (DRY max - COOL min) /6 x 1 + COOL min

Hz	09LKV-UL	12LKV-UL
Cool min	20	11
DRY max	35	31

< Heating Operation >

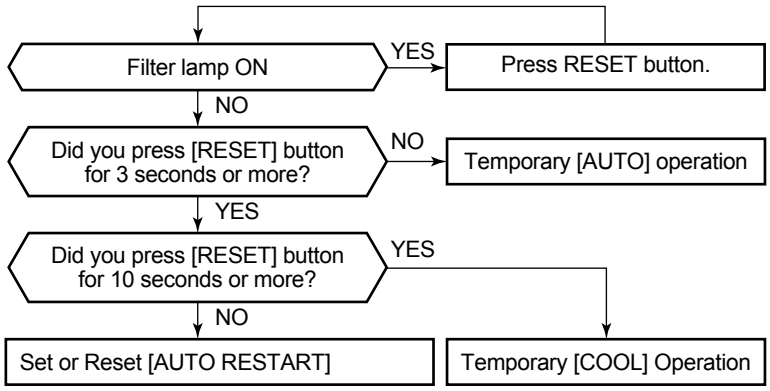


Compressor speed (Hz)

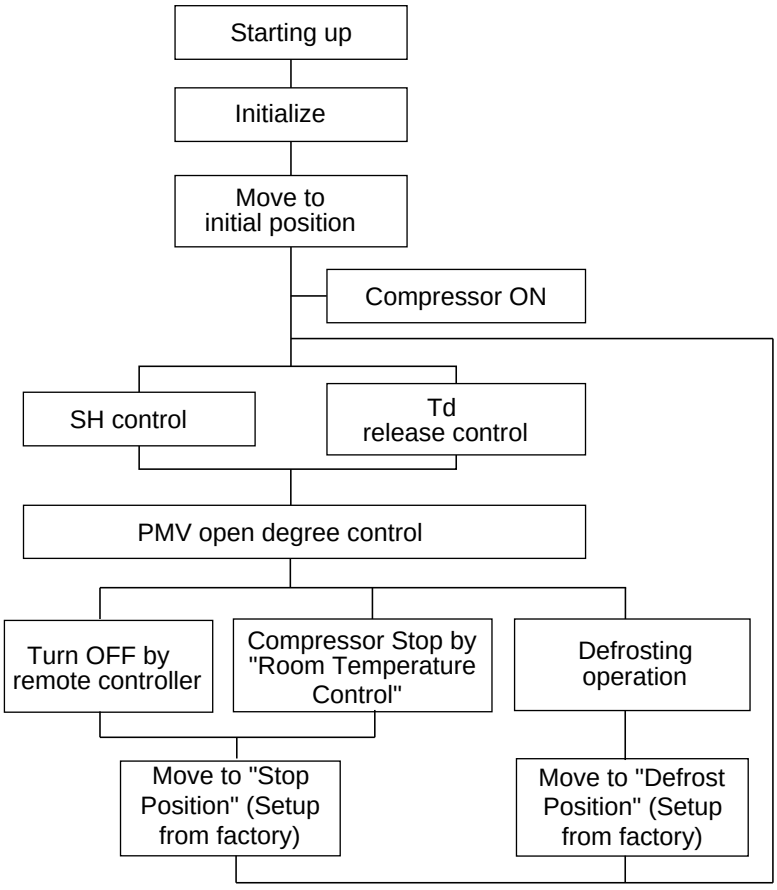
Zone	Model	
	09LKV-UL	12LKV-UL
A	20	13
B	Linear aproximation between A to C	
C	50	43

<Heating operation>

1) The difference of room temperature and set temperature are separated in to A zone, B zone and C zone.
   Three zone will changed again 30 minutes after ECO operation start.
2) The compressor speed is controlled as shown on the table.
3) The indoor fan speed is not controlled and can be selected during the ECO operation.

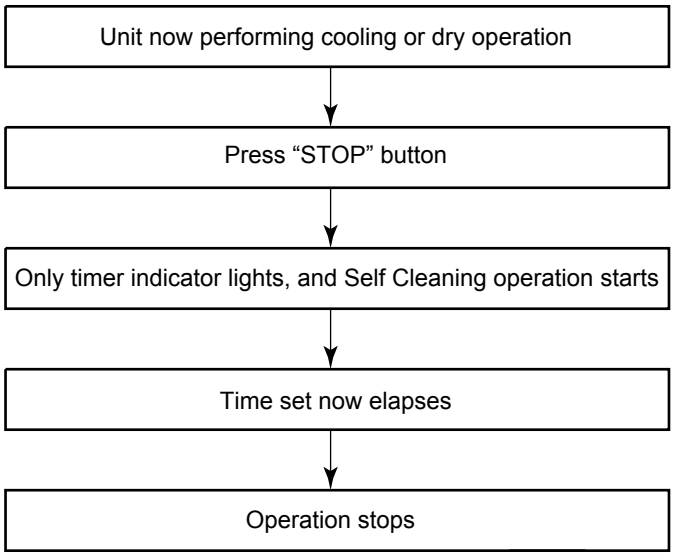
Item	Operation flow and applicable data, etc.	Description
10. Temporary operation	Pressing [RESET] button starts the temporary operation of [AUTO] operation. When keeping [RESET] button pressed for 10 seconds or more, the temporary [COOL] operation is performed. 	1) When pressing [RESET] button, the temporary [AUTO] operation starts. 2) When keeping [RESET] button pressed for 3 seconds or more, Pi, Pi, Pi sound is heard and [AUTO RESTART] control is changed. 3) When keeping [RESET] button pressed for 10 seconds or more, “Pi” sound is heard and the temporary [COOL] operation starts. 4) If the filter lamp goes on, press [RESET] button to go off the filter lamp, and then press [RESET] button again. 5) To stop the temporary operation, press the button again.
11. Discharge temperature control **Td value** / **Control operation** 243°F (117°C) — Judges as an error and stops the compressor. 233°F (112°C) — Reduce the compressor speed. 226°F (108°C) — Reduce slowly compressor speed. 221°F (105°C) — Keeps the compressor speed. 208°F (98°C) — If the operation is performed with lower speed than one commanded by the serial signal, speed is slowly raised up to the commanded speed. Operates with speed commanded by the serial signal.		**1. Purpose** This function detects error on the refrigerating cycle or error on the compressor, and performs protective control. **2. Operation** • Control of the compressor speed The speed control is performed as described in the left table based upon the discharge temperature.

Item	Operation flow and applicable data, etc.	Description
12. Pulse Modulating valve (P.M.V.) control	This function controls throttle amount of the refrigerant in the refrigerating cycle. According to operating status of the air conditioner, this function also controls the open degree of valve with an expansion valve with pulse Modulation.	1) When starting the operation, move the valve once until it fits to the stopper. (Initialize) * In this time, “Click” sound may be heard. 2) Adjust the open degree of valve by super heat amount. (SH control) 3) If the discharge temperature was excessively up, adjust the open degree of valve so that it is in the range of set temperature. (Discharge temp. control) 4) When defrost operation is performed, the open degree of valve is adjusted according to each setup conditions during preparation for defrost and during defrost operation (4-way valve is inversed.). 5) When operation is OFF by the remote controller or when compressor is OFF by room temperature control, the open degree of valve is adjusted to the stop position.



* SH (Super Heat amount) =
  Ts (Temperature of suction pipe of the compressor) –
  Tc or Te (Heat exchanger temperature at evaporation side)
* PMV: Pulse Modulating Valve

Item	Operation flow and applicable data, etc.	Description
13. Self-Cleaning function		**1. Purpose** The Self-Cleaning operation is to minimize the growth of mold, bacteria etc. by running the fan and drying so as to keep the inside of the air conditioner clean. **Self-Cleaning operation** When the cooling or dry operation shuts down, the unit automatically starts the Self-Cleaning operation which is then performed for the specified period based on duration of the operation which was performed prior to the shutdown, after which the Self-Cleaning operation stops. (The Self-Cleaning operation is not performed after a heating operation.) **2. Operation** 1) When the stop signal from the remote controller or timer-off function is received, only the timer indicator light. 2) The period of the Self-Cleaning operation is determined by the duration of the operation performed prior to the reception of the stop code. 3) After the Self-Cleaning operation has been performed for the specified period, the unit stops operating.



- During Self-Cleaning operations: The louver opens slightly. The indoor fan operates continuously at a speed of 500 rpm.

Self-Cleaning operation times

	Operation time	Self-Cleaning operation time
Cooling: Auto (cooling) Dry	Up to 10 minutes	No Self-Cleaning operation performed (0 minutes)
	10 minutes or longer	30 mins.
Heating: Auto (heating)	No Self-Cleaning operation performed	
Auto (fan only)		
Shutdown		

- To stop an ongoing Self-Cleaning operation at any time
  Press the start/stop button on the remote controller twice during the Self-Cleaning operation. (After pressing the button for the first time, press it for the second time without delay (within 10 minutes).)

Item	Operation flow and applicable data, etc.	Description
13. Self-Cleaning function	• Self-Cleaning diagram	

Operation display	ON	OFF	OFF
FCU fan	ON rpm is depend on presetting.	ON (500RPM)	OFF
FCU louver	OPEN	OPEN (12.7º)	CLOSE
Timer display	ON or OFF depend on presetting of timer function.	ON	ON or OFF depend on presetting of timer function.
Compressor	ON or OFF depend on presetting per room temperature.	OFF	OFF
CDU fan	ON or OFF depend on presetting per room temperature.	OFF	OFF

Operation time

Cool mode or dry mode operation more than 10 mins.

Self-Cleaning mode operate 30 mins.

Turn off by remote controller or timer-off function.

Automatically turn-off.

How to Set or Cancel Self-Cleaning operation.
(Default setting from factory is ON)

1. Connect jumper lead at J201 of the indoor P.C. board assembly.

2. To cancel Self-Cleaning operation.

Turn the power supply ON

↓

Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.

↓

After 3 seconds, the unit beeps three times.
The Self-Cleaning is cancelled.

3. To set Self-Cleaning operation.

Turn the power supply ON

↓

Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.

↓

After 3 seconds, the unit beeps three times and the **indicator blinks for 5 seconds**.
The Self-Cleaning is set.

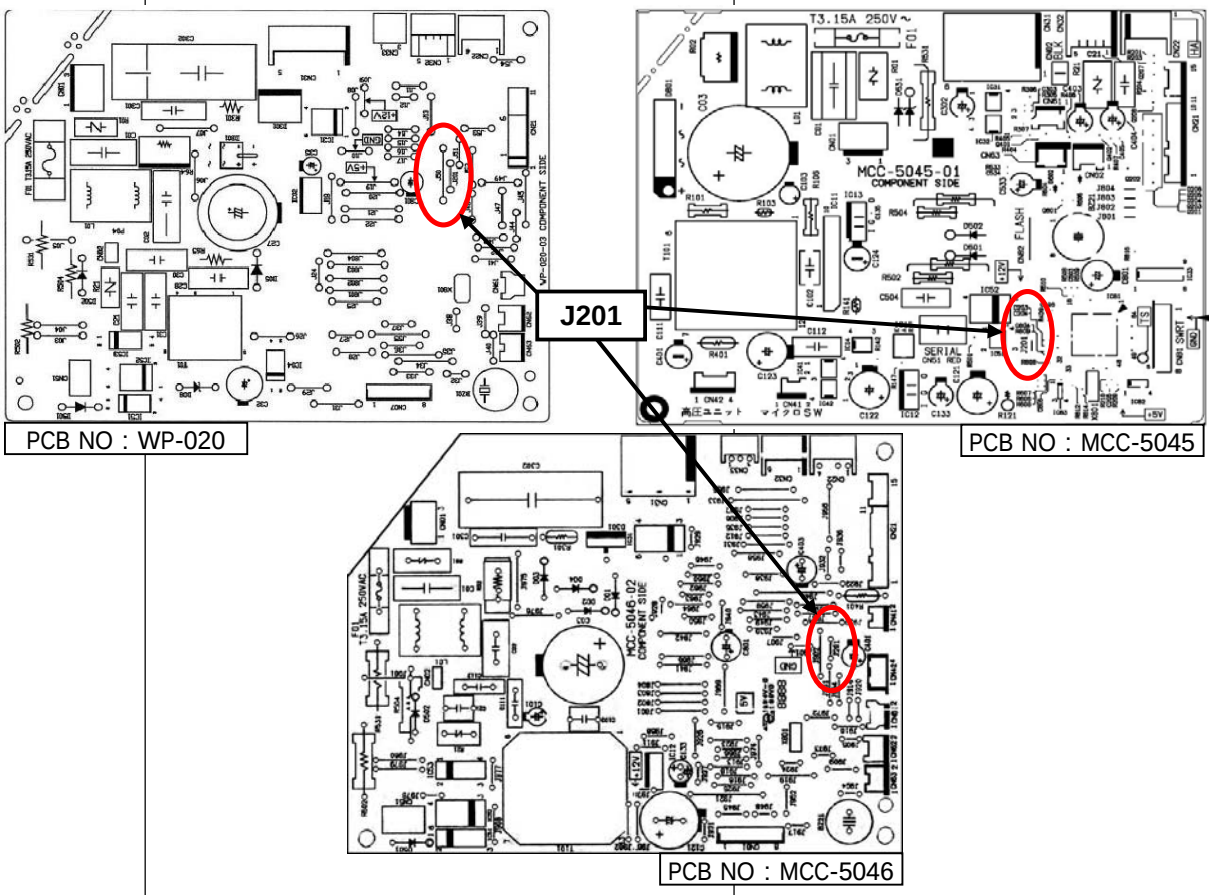
One J201 is added, it will effect as following.

- The operation when press the RESET button for 3 seconds will be changed from Set/Cancel the AUTO-RESTART to Set/Cancel the Self-Cleaning.
- AUTO-RESTART function will not activate. In case of AUTO-RESTART is need, disconnect the jumper J201 and set it again after Set/Cancel the Self-Cleaning finished.

Note :

J201 is near the MCU, so so take steps to ensure that it will not be exposed to excessive of heat.
Also take care to avoid solder bridging with the surrounding components.

Item	Operation flow and applicable data, etc.	Description



14. Remote-A or B selection

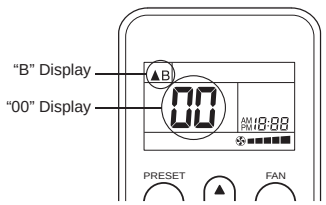
Setting the remote controller

To separate using of remote control for each indoor unit in case of 2 air conditioner are installed nearly.

Remote Control B Setup.

1) Press RESET button on the indoor unit to turn the air conditioner ON.
2) Point the remote control at the indoor unit.
3) Push and hold CHK • button on the Remote Control by the tip of the pencil. "00" will be shown shown on the display.
4) Press MODE • during pushing CHK •. "B" will show on the display and "00" will disappear and the air conditioner will turn OFF. The Remote Control B is memorized.

Note : 1. Repeat above step to reset Remote Control to be A.
2. Remote Control A has not "A" display.
3. Default setting of Remote Control from factory is A.



1. Purpose

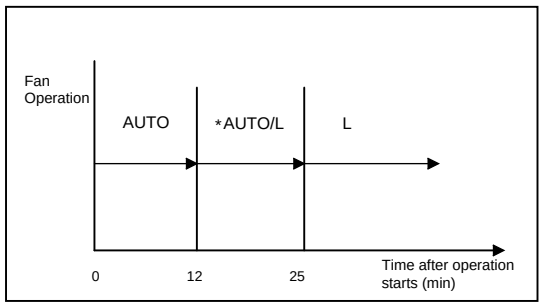
This operation is to operate only one indoor unit using one remote controller.

2. Description

When operating one indoor unit in a situation where two indoor units have been installed in the same room or nearby rooms, this operation prevents the remote controller signal from being received simultaneously by both units, thus preventing both units from operating.

3. Operation

The indoor unit on which the remote controller selection has been set to B receives the signal of the remote controller also set to B.
(At the factory the remote controller selection is set to A on all the indoor units. There is no A setting display.)

Item	Operation flow and applicable data, etc.	Description
15. QUIET mode	When the [QUIET] button is pressed, the fan of the indoor unit will be restricted the revolving speed at speed L－ until the [QUIET] button is pressed once again (cancel Quiet mode).	Quiet mode is the system which, control the revolving speed of indoor fan to work constantly at lower than speed L. In addition, noise level of indoor unit is less than usual. Remarks : 1. Quiet mode is unable to work in dry mode. 2. Quiet mode is appropriate to work with less cooling load and less heating load condition. Because of the fan speed L- may cause not enough the cooling capacity or heating capacity.
16. COMFORT SLEEP	**Cooling mode** • The preset temperature will increase as show on ECO operation (Item No. 9) • Press the [COMFORT SLEEP] button to choose the operating hours. Repeat pressing to select the hours. (1hr, 3hr, 5hr or 9hr) • If the [COMFORT SLEEP] button is pressed again means cancel comfort sleep mode. **Heating mode** • The preset temperature will drop down as show on ECO operation (Item No. 9) • Press the [COMFORT SLEEP] button to choose the operating hours. Repeat pressing to setect thehours. (1hr, 3hr, 5hr or 9 hr) • If the [COMFORT SLEEP] button is pressed again means cancel comfort sleep mode.	The principles of comfort sleep mode are: • Quietness for more comfortable. When room temperature reach setting temperature • Save energy by changing room temperature automatically. • The air condition can shut down by itself automatically. Remarks: Comfort sleep mode will not operate in dry mode and fan only mode.
17. One-Touch Comfort	One touch comfort is the fully automated operation that is set according to the preferable condition in a region.  *AUTO/L: Fan operates depends on the setting temperature and room temperature. During the One Touch Comfort mode if the indoor unit receives any signal with other operation mode, the unit will cancel the comfort mode and operates according to the signal received.	**Operation condition for model to Europe market** When an indoor unit receives "One Touch Comfort Signal" from the remote controller, the indoor unit operates as following. 1) Air conditioner starts to operation when the signal is received, even if the air conditioner was OFF. 2) Operation mode is set according to room temperature, the same as AUTO mode. 3) Target temperature is 75°F (24ºC). 4) Louver position is set as stored position of the operating mode. 5) Fan is controlled as followings.

Item	Operation flow and applicable data, etc.	Description
18. Hi-POWER Mode	**([Hi-POWER] button on the remote controller is pressed)** When [Hi-POWER] button is pressed while the indoor unit is in Auto, Cooling or Heating operation, Hi-POWER mark is indicated on the display of the remote controller and the unit operates as follows. **1. Automatic operation** • The indoor unit operates in according to the current operation. **2. Cooling operation** • The preset temperature drops 2.0°F (1ºC) (The value of the preset temperature on the remote controller does not change.) The indoor unit's fan speed level increase 1 tap **3. Heating operation** • The preset temperature increases 3.5°F (2ºC) (The value of the preset temperature on the remote controller does not change.) The indoor unit's fan speed level increase 1 tap **4. The Hi-POWER mode can not be set in Dry operation**	∗ The Hi-POWER operation will be cancelled when press [Hi-POWER] button again.
19. FILTER Indicator	When the elapsed time reaches 1000 hours after conditioner operation, the FILTER indicator lights. After cleaning the filters, turn off the FILTER indicator. **How to Turn Off FILTER Indicator** Press [RESET] button on the indoor unit. **NOTE :** If [RESET] button is pushed while the FILTER indicator is not lit, the indoor unit will start the automatic operation.	

9-3. Auto Restart Function (Default setting from factory is ON).

This indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of a power supply being accidentally shut down.
The operation will resume without warning three minutes after power is restored.

This function is set to work from the factory.

The Auto Restart Function will not restart operation of the air conditioner in following case.

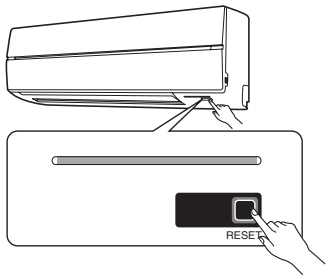
- The Auto Restart Function is setup to OFF.
- The power supply is shut down during the air conditioner is OFF.
- The power supply is shut down when timer operatio is set.

9-3-1. How to Cancel the Auto Restart Function

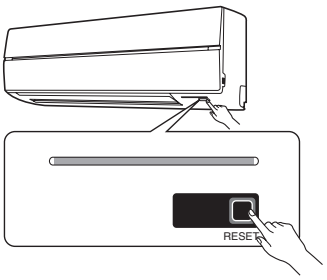
To cancel Auto Restart Function, proceed as follows.

1. The power supply to the unit must be ON ; The function will not set or reset if the power supply is OFF.
2. Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.
3. After 3 seconds, the unit beeps three times.

• When the system is on stand-by (not operating)

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds) 	The unit is on standby. ↓ The unit starts to operate. The green indicator is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. If the unit is not required to operate at this time, press [RESET] button once more or use the remote controller to turn it off.

• When the system is operating

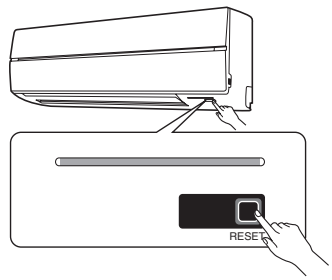
Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds) 	The unit is in operation. The green indicator is on. ↓ The unit stops operating. The green indicator is turned off. ↓ After approx. three seconds, The unit beeps three times. If the unit is required to operate at this time, press [RESET] button once more or use the remote controller to turn it on.

9-3-2. How to Set the Auto Restart Function

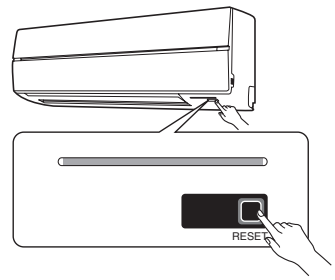
To set Auto Restart Function, proceed as follows:

1. The power supply to the unit must be ON ; The function will not set or reset if the power supply is OFF.
2. Press the [RESET] button located on the front panel of the indoor unit for more than 3 seconds.
3. After 3 seconds, the unit beeps three times and the indicator blinks for 5 seconds.

• When the unit is standby (Not operating)

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  	The unit is on standby. ↓ The unit starts to operate. The green indicator is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. **The green indicator flashes for 5 seconds.** If the unit is not required to operate at this time, press [RESET] button once more or use the remote controller to turn it off.

• When the unit is in operation

Operation	Motions
Press [RESET] button for more than three seconds. (Less than 10 seconds)  	The unit is in operation. The green indicator is on. ↓ The unit stops operating. The green indicator is turned off. ↓ After approx. three seconds, The unit beeps three times. **The green indicator flashes for 5 seconds.** If the unit is required to operate at this time, press [RESET] button once more or use the remote controller to turn it on.

• While the filter check indicator is on, the RESET button has the function of filter reset betton.

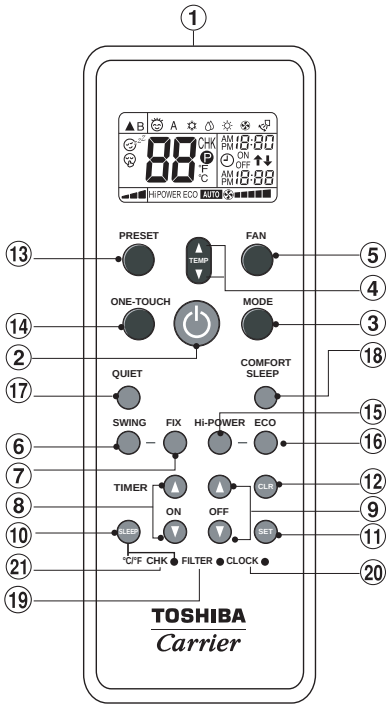
9-3-3. Power Failure During Timer Operation

- If Timer operation is set and the power supply shut down accidentally, the previous Timer setting will be cancelled.
- Daily-Timer operation will be not affected by power supply failure, if the remote controller is located on the position which it can send the command signal to the indoor unit. It is because the remote controller will send signal every 30 minutes and Daily-Timer operation will be restore.

9-4. Remote controller and Its functions

9-4-1. Parts name of remote controller

① Infrared signal emitter
② Start/Stop button
③ Mode select button (MODE)
④ Temperature button (TEMP)
⑤ Fan speed button (FAN
⑥ Swing louver button (SWING)
⑦ Set louver button (FIX)
⑧ On timer button (ON)
⑨ Off timer button (OFF)
⑩ Sleep timer button (SLEEP)
⑪ Setup button (SET)
⑫ Clear button (CLR)
⑬ Memory and Preset button (PRESET)
⑭ One Touch button (ONE-TOUCH)
⑮ High power button (Hi-POWER)
⑯ Economy button (ECO)
⑰ Quiet button (QUIET)
⑱ Comfort sleep button (COMFORT SLEEP)
⑲ Filter reset button (FILTER)
⑳ Clock Reset button (CLOCK)
㉑ Check button (CHK)



9-4-2. Operation of remote control

1. ONE-TOUCH

Press the "ONE-TOUCH" button for fully automated operation that is customised to the typical consumer preferences in your region of the world. The coutomised settings control temperature air flow strength, air flow direction and other settings to provide you alternate contact with "ONE-TOUCH" OF THE BUTTON. If you prefer other settings you can select from the many other operation functions of your Toshiba carrier unit

Press ● ONE-TOUCH : Start the operaton.

2. AUTOMATIC OPERATION

To automatically select cooling, heating, or fan only operation.

1. Press ● MODE : Select A.
2. Press TEMP : Set the desired temperature.

3. COOLING / HEATING / FAN ONLY OPERATION

1. Press ● MODE : Select Cool, Heat, or Fan only.
2. Press TEMP : Set the desired temperature.
   Cooling: Min. 62°F (17°C), Heating : Max, 86°F (30°C), Fan Only: No temperature indication
3. Press ● FAN : Select AUTO, LOW, LOW+, MED, MED+, or HIGH.

4. DRY OPERATION (COOLING ONLY)

For dehumidification, a moderate cooling performance is controlled automatically.

1. Press ● MODE : Select Dry 💧 .
2. Press TEMP : Set the desired temperature.

5. Hi-POWER OPERATION

To automatically control room temperature and airflow for faster cooling or heating operation (except in DRY and FAN ONLY mode)

Press ● HI-POWER : Start and stop the operation.

6. ECO OPERATION

To automatically control room to save energy (except in DRY and FAN ONLY mode)

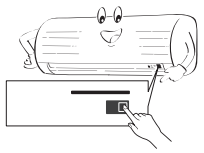
Press ● ECO : Start and stop the operation.

Note: Cooling operation; the set temperature will increase automatically 1.8°F (1°C)/ hour for 2 hours (maximum 3.6°F (2°C) increase). For heating operation the set temperature will decrease.

7. TEMPORARY OPERATION

In case of the misplaced or discharged remote control

- Pressing the RESET button, the unit can start or stop without using the remote control.
- Operation mode is set on AUTOMATIC operation, preset temperature is 75°F (24°C) and fan operation is automatic speed.



8. TIMER OPERATION

	Setting the ON Timer	Setting the OFF Timer
1	Press ▲ ON ▼ : Set the desired ON timer.	Press ▲ OFF ▼ : Set the desired OFF timer.
2	Press SET : Set the timer	Press SET : Set the timer.
3	Press CLR : Cancel the on timer	Press CLR : Cancel the OFF timer.

Everyday timer allows the user to set both the ON & OFF timers and will be activated on a daily basis.

Setting Everyday Timer

1	Press ▲ ON ▼ : Set the ON timer.	3	Press SET.
2	Press ▲ OFF ▼ : Set the OFF timer.	4	Press SET button during the (⬆ or ⬇) mark flashing.

- During the every day timer is activation, both arrows (⬆ or ⬇) are indicated.

Note:

- Keep the remote control in accessible transmission to the indoor unit; otherwise, the time lag of up to 15 minutes will occur.
- The setting will be saved for the next same operation.

9. PRESET OPERATION

Set your preferred operation for future use. The setting will be memorized by the unit for future operation (except air flow direction).

1. Select your preferred operation.
2. Press and hold ● PRESET for 3 seconds to memorize the setting. The Ⓟ mark displays.
3. Press ● PRESET : Operate the preset operation.

10. AUTO RESTART OPERATION

To automatically restart the Air conditioner after the power failure (Power of the unit must be on.)

Setting

1. AUTO RESTART is an initial setting from factory.
   - Do not operate ON timer and OFF timer.
2. Press and hold the RESET button on the indoor unit for 3 seconds to cancel the operation. (3 beep sound but OPERATION lamp does not blink)

11. QUIET OPERATION

To operate at super low fan speed for quiet operation (except in DRY mode)

Press ● QUIET : Start and stop the operation.

Note: Under certain conditions, QUIET operation may not provide adequate cooling or heating due to low sound features.

12. COMFORT SLEEP OPERATION

To save energy while sleeping, automatically control air flow and automatically turn OFF.

Press ● COMFORT SLEEP : Select 1, 3, 5 or 9 hrs for OFF timer operation.

Note: The cooling operation, the set temperature will increase automatically 1.8°F (1°C)/hour for 2 hours (maximum 3.6°F (2°C) increase). For heating operation, the set temperature will decrease.

13. SLEEP TIMER OPERATION

To start the sleep timer (OFF timer) operation

Press ● SLEEP : Select 1, 3, 5 or 9 hrs for OFF timer operation.

9-4-3. Name and Functions of Indications on Remote Controller

[Display]

All indications, except for the clock time indicator, are displayed by pressing the ⏻ button.

1 **Transmission mark**

This transmission mark ▲ indicates when the remote controller transmits signals to the indoor unit.

2 **Mode indicator**

Indicates the current operation mode.
(A : Automatic control ☼ : Cool,
💧 : Dry, ☼ : Heat, 🌀 : Fan only)

3 **Temperature indicator**

Indicates the temperature setting.
[62°F to 86°F (17°C to 30°C)]

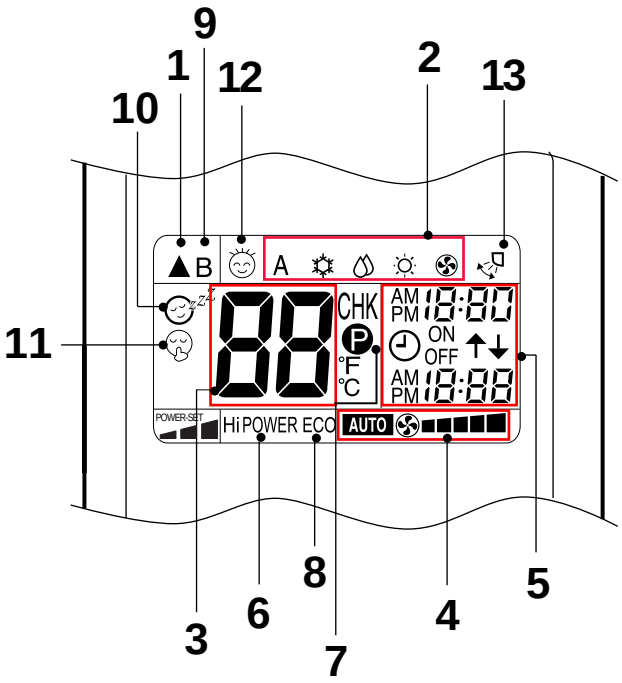
4 **FAN speed indicator**

Indicates the selected fan speed.

AUTO or five fan speed levels

(LOW ▁ , LOW⁺ ▁▂ , MED ▁▂▃ , MED⁺ ▁▂▃▄ , HIGH ▁▂▃▄▅) can be shown.

Indicates AUTO when the operating mode is either AUTO or 💧 : Dry.



5 **TIMER and clock time indicator**

The time setting for timer operation or the clock time is indicated.

The current time is always indicated except during TIMER operation.

6 **Hi-POWER indicator**

Indicates when the Hi-POWER operation starts.

Press the Hi-POWER button to start and press it again to stop the operation.

7 **Ⓟ (PRESET) indicator**

Flashes for 3 seconds when the PRESET button is pressed during operation.

The Ⓟ mark is shown when holding down the button for more than 3 seconds while the mark is flashing.

Press another button to turn off the mark.

8 **ECO indicator**

Indicates when the ECO is in activated.

Press the ECO button to start and press it again to stop operation.

9 **A, B change indicator remote controller**

When the remote controller switching function is set, “B” appears in the remote controller display. (When the remote controller setting is “A”, there is no indication at this position.)

10 ***Comfort sleep***

Indicates when comfort sleep is activaled.
Press comfort sleep button to select function.

11 ***Quiet***

Indicates when quiet is activated.
Press quiet button to start and press it again to stop operation.

12 ***One-Touch***

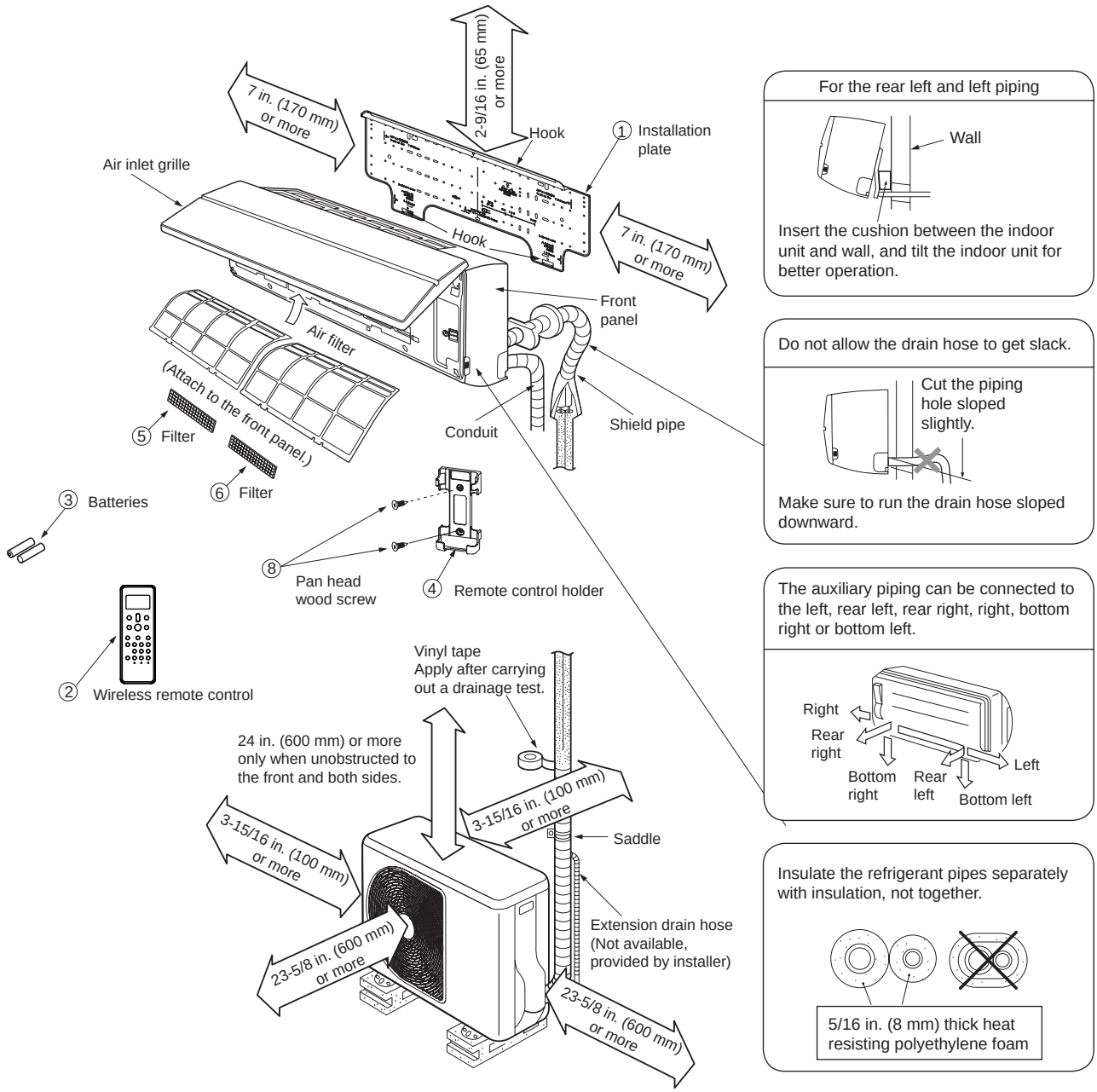
Indicates when one touch comfort is activated.
Press one-touch button to start the operation.

13 ***Swing***

Indicates when louver is swing.
Press swing button to start the swing operation and press it again to stop the swing operation.

10. INSTALLATION PROCEDURE

10-1. Installation Diagram of Indoor and Outdoor Units



For the rear left and left piping

Insert the cushion between the indoor unit and wall, and tilt the indoor unit for better operation.

Do not allow the drain hose to get slack.

Make sure to run the drain hose sloped downward.

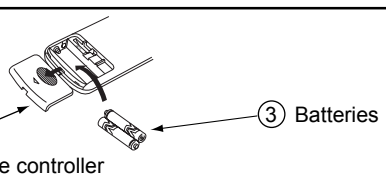
The auxiliary piping can be connected to the left, rear left, rear right, right, bottom right or bottom left.

Insulate the refrigerant pipes separately with insulation, not together.

5/16 in. (8 mm) thick heat resisting polyethylene foam

Before installing the wireless remote controller

- Loading Batteries
  1. Remove the battery cover.
  2. Insert 2 new batteries (AAA type) following the (+) and (–) positions.



10-2. Installation

10-1-2. Optional installation parts

Part Code	Parts name	Q'ty
Ⓐ	Refrigerant piping Liquid side : ∅1/4 in. (∅6.35 mm) Gas side : ∅3/8 in. (∅9.52 mm)	One each
Ⓑ	Pipe insulating material (polyethylene foam, 6 mm thick)	1
Ⓒ	Putty, PVC tapes	One each

<Fixing bolt arrangement of outdoor unit>

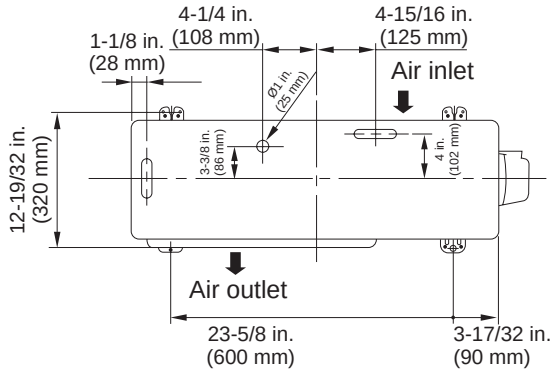
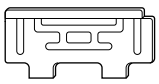
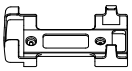
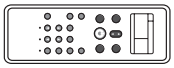
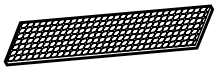


Fig. 10-2-1

- Secure the outdoor unit with fixing bolts and nuts if the unit is likely to be exposed to a strong wind.
- Use ∅5/16 in. (∅8 mm) or ∅3/8 in. (∅10 mm) anchor bolts and nuts.

10-2-2. Accessory and installation parts

Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)
①	 Installation plate x 1	④	 Remote control holder x 1	⑦	Mounting screw ∅5/32 x 1ℓ (∅4mm x 25ℓ) x 6
②	 Wireless remote control x 1	⑤	 Filter x 1	⑧	Pan head wood screw ∅1/8 x 5/8 ℓ (∅3.1mm x 16ℓ) x 2
③	Battery x 2	⑥	Filter x 1		

Others

Name
Owner's manual
Installation manual

10-2-3. Installation/Servicing Tools

Changes in the product and components

In the case of an air conditioner using R410A, in order to prevent any other refrigerant from being charged accidentally, the service port diameter of the outdoor unit control valve (3 way valve) has been changed. (1/2 UNF 20 threads per inch)

- In order to increase the pressure resisting strength of the refrigerant piping flare processing diameter and size of opposite side of flare nuts has been changed. (for copper pipes with nominal dimensions 1/2 and 5/8)

New tools for R410A

New tools for R410A	Applicable to R22 model		Changes
Gauge manifold	×		As pressure is high, it is impossible to measure by means of conventional gauge. In order to prevent any other refrigerant from being charged, each port diameter has been changed.
Charge hose	×		In order to increase pressure resisting strength, hose materials and port size have been changed (to 1/2 UNF 20 threads per inch). When purchasing a charge hose, be sure to confirm the port size.
Electronic balance for refrigerant charging	○		As pressure is high and gasification speed is fast, it is difficult to read the indicated value by means of charging cylinder, as air bubbles occur.
Torque wrench (nominal diam. 1/2, 5/8)	×		The size of opposite sides of flare nuts have been increased. Incidentally, a common wrench is used for nominal diameters 1/4 and 3/8.
Flare tool (clutch type)	○		By increasing the clamp bar's receiving hole, strength of spring in the tool has been improved.
Gauge for projection adjustment	—	—	Used when flare is made by using conventional flare tool.
Vacuum pump adapter	○		Connected to conventional vacuum pump. It is necessary to use an adapter to prevent vacuum pump oil from flowing back to the charge hose. The charge hose connecting part has two ports-one for conventional refrigerant (7/16 UNF 20 threads per inch) and one for R410A. If the vacuum pump oil (mineral) mixes with R410A a sludge may occur and damage the equipment.
Gas leakage detector	×		Exclusive for HFC refrigerant.

- Incidentally, the "refrigerant cylinder" comes with the refrigerant designation (R410A) and protector coating in the U. S's ARI specified rose color (ARI color code: PMS 507).
- Also, the "charge port and packing for refrigerant cylinder" require 1/2 UNF 20 threads per inch corresponding to the charge hose's port size.

10-3. Indoor Unit

10-3-1. Installation Location

- A location which provides enough spaces around the indoor unit as shown in the diagram.
- A location where there are no obstacle near the air inlet and outlet.
- A location which allows easy installation of the piping to the outdoor unit.
- A location which allows the front panel to be opened.
- The indoor unit shall be installed so that the top of the indoor unit is positioned at least 6.6 ft (2 m) in height. Also, it must be avoided to put anything on the top of the indoor unit.
- Location that will bear weight of the unit.

CAUTION

- Direct sunlight on the indoor unit wireless receiver should be avoided.
- The microprocessor in the indoor unit should not be too close to RF noise sources. (For details, see the owner's manual.)

Remote controller

- Should be placed where there are no obstacles, such as curtains, that may block the signal.
- Do not install the remote controller in a place exposed to direct sunlight or close to a heating source, such as a stove.
- Keep the remote controller at least 3.3 ft (1 m) away from the nearest TV set or stereo equipment. (This is necessary to prevent image disturbances or noise interference.)
- The location of the remote controller should be determined as shown below.

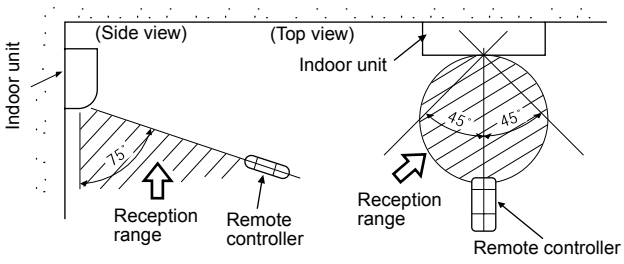


Fig. 10-3-1

10-3-2. Cutting a Hole and Mounting the mounting Plate

Cutting a hole

When installing the refrigerant pipes from the rear.

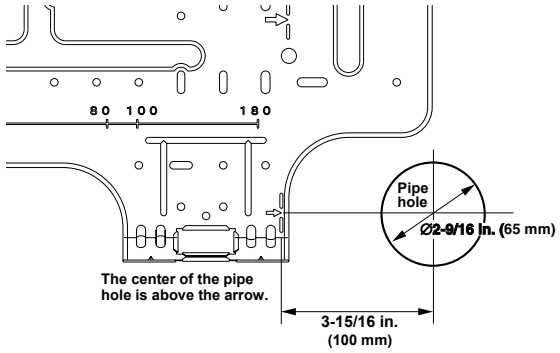


Fig. 10-3-2

1. After determining the pipe hole position on the mounting plate (⇨), drill the pipe hole ∅2-9/16 in. (∅65 mm) at a slight downward slant to the outdoor side.

NOTE :

- When drilling into a wall that contains a metal lath, wire lath or metal plate, be sure to use a pipe hole brim ring sold separately.

Mounting the mounting plate

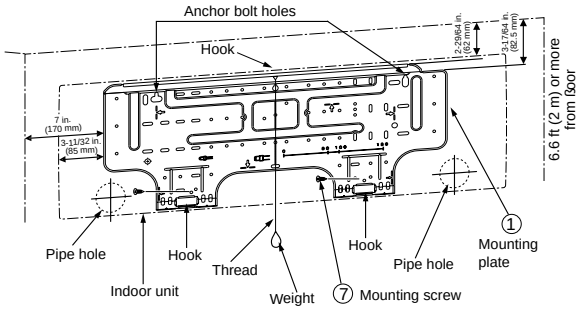


Fig. 10-3-3

When the installation plate is directly mounted on the wall

1. Securely fit the installation plate onto the wall by screws with the upper and lower catches, that hold the indoor unit, facing out.
2. To mount the installation plate on a concrete wall use anchor bolts. Drill the anchor bolt holes as illustrated in the above figure.
3. Install the installation plate horizontally and level.

CAUTION

When installing the mounting plate with mounting screw, do not use the anchor bolt hole. Otherwise, the unit may fall down and result in personal injury and property damage.

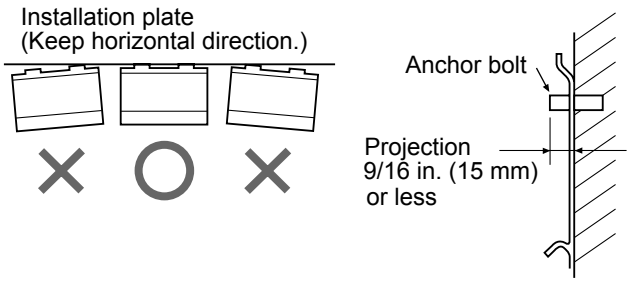


Fig. 10-3-4

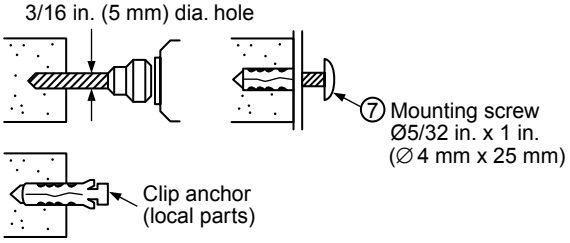


Fig. 10-3-5

CAUTION

Failure to firmly install the unit may result in personal injury and property damage if the unit falls.

- In case of block, brick, concrete or similar type walls, make 3/16 in. (5 mm) dia. holes in the wall.
- Insert clip anchors for appropriate mounting screws ⑦.

NOTE :

- Secure four corners and lower parts of the mounting plate with 4 to 6 mounting screws to install it.

10-3-3. Electrical Work

1. The supply voltage must be the same as the rated voltage of the air conditioner.
2. Prepare a power source for the exclusive use of the air conditioner.

NOTE :

- Wire type :
  minimum AWG 14.

CAUTION

- This appliance can be connected to a main circuit breaker in either of the following two ways.
  1. Connection to fixed wiring:
     A switch or circuit breaker which disconnects all poles and has a contact separation of at least 1/8 in. (3 mm) must be incorporated in the fixed wiring. An approved circuit breaker or switch must be used.
  2. Connection with power supply plug:
     Attach power supply plug with power cord and plug it into wall outlet. An approved power supply cord and plug must be used.

NOTE :

- Perform wiring work being sure the wire length is long enough.

10-3-4. Wiring Connection

How to connect the connecting cable

1. Open the air inlet grille upward.
2. Remove the screws securing the front panel.
3. Slightly open the lower part of the front panel, then pull the upper part of the front panel toward you to remove it from the rear plate.
4. Insert the condit pipe (according to the local rule) into the pipe hole on the wall.
5. Remove the conduit mount by loosening the fixing screw. (Fig. 10-3-7)
6. Fix conduit pipe to conduit mount with lock nut.
7. Pull out the connecting wire through the conduit pipe and process the wire. (Fig. 10-3-8)
8. Take out the wire to the front and fix it to the terminal block. Be careful not to make mis-wiring (Fig. 10-3-9)
9. Firmly tighten the terminal screws to prevent them from loosening. Tightening torque: 0.9 lbf. ft (1.2 N·m). After tightening, pull the wires lightly to confirm that they of not move.
10. Secure the connecting wire with the cord clamp.
11. Fix the conduit mount back to the body by fixing a screw.
12. Fix the front panel, terminal cover and air inlet grille on the indoor unit.

CAUTION

- Be sure to refer to the wiring system diagram labeled inside the front panel.
- Check local electrical regulations for any specific wiring instructions or limitations.

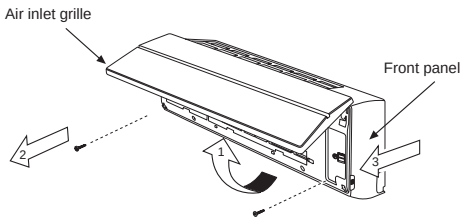


Fig. 10-3-6

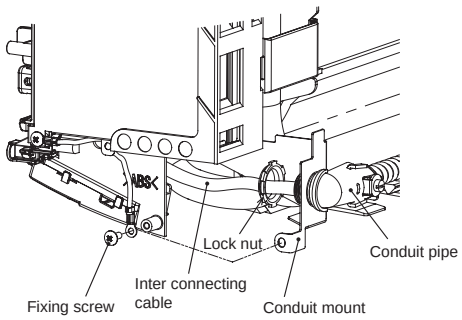


Fig. 10-3-7

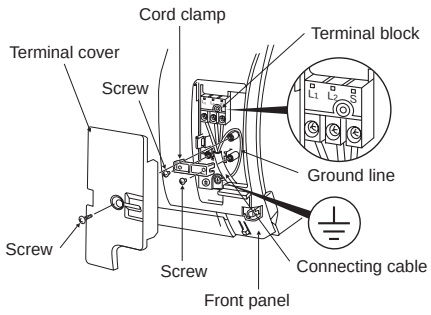


Fig. 10-3-8

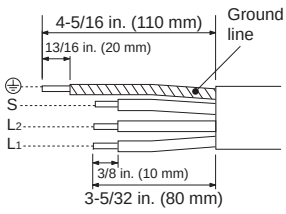


Fig. 10-3-9

NOTE :

- Use stranded wire only.
- Wire type : minimum AWG14

10-3-5. Piping and Drain Hose Installation

Piping and drain hose forming

- Since condensation results in machine trouble, make sure to insulate both the connecting pipes separately.
  (Use polyethylene foam as insulating material.)

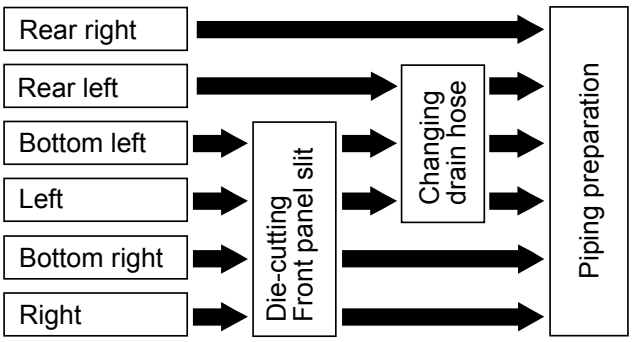


Fig. 10-3-10

1. Die-cutting front panel slit

Cut out the slit on the left or right side of the front panel for the left or right connection and the slit on the bottom left or side of thefront panel for the bottom left or right connection with a pair of nippers.

2. Changing drain hose

For left connection, left-bottom connection and rear-left connection's piping, it is necessary to relocate the drain hose and drain cap.

How to remove the drain cap

Clip drain cap with needle-nose pliers, and pull out.

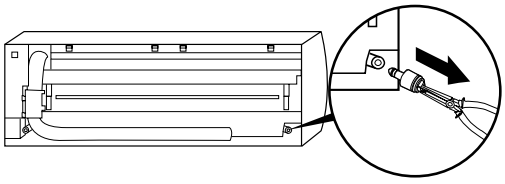


Fig. 10-3-11

How to remove the drain hose

The drain hose is secured in place by a screw.

Remove the screw securing the drain hose, then pull out the drain hose.

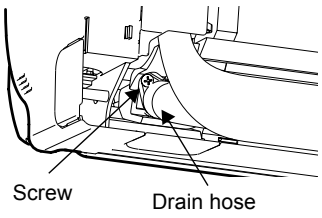


Fig. 10-3-12

How to attach the drain cap

1. Insert hexagonal wrench 3/16 in. (4 mm).

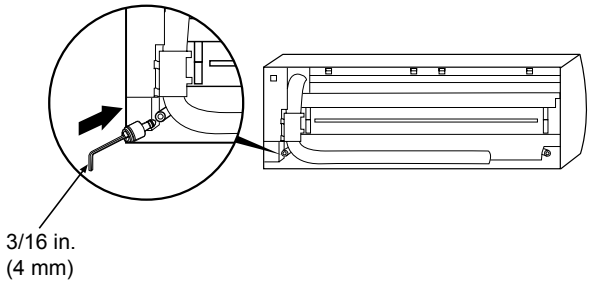


Fig. 10-3-13

2. Firmly insert drain cap.

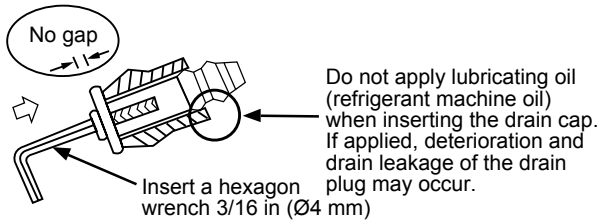


Fig. 10-3-14

How to attach the drain hose

Always use the original screw that secured the drain hose to the unit. If using a different screw may cause water to leak.

Insert the drain hose firmly until the connector contacts with the insulation, then secure it in place using the original screw.

CAUTION

Securely insert the drain hose and drain cap; otherwise, water may leak.

In case of right or left piping

- After making slits on the front panel with a knife or similar tool, cut them out with a pair of nippers or an equivalent tool.

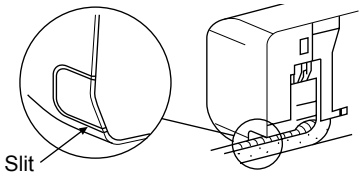


Fig. 10-3-15

In case of bottom right or bottom left piping

- After making slits on the front panel with a knife or similar tool, cut them out with a pair of nippers or an equivalent tool.

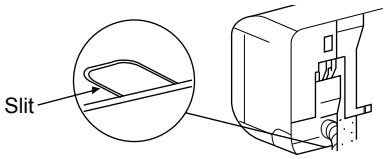


Fig. 10-3-16

Left-hand connection with piping

Bend the connecting pipes so that they are positioned within 1-5/8 in. (43 mm) above the wall surface.

If the connecting pipes are positioned more than 1-5/8 in (43 mm) above the wall surface, the indoor unit may be unstable.

When bending the connecting pipe, make sure to use a spring bender to avoid crushing the pipe.

Refer to the table below for the bending radius of each connection pipe.

Outer diameter	Bending radius
∅ 1/4 in. (6.35 mm)	1-3/16 in. (30 mm)
∅ 3/8 in. (9.52 mm)	1-9/16 in. (40 mm)
∅ 1/2 in. (12.7 mm)	1-31/32 in. (50 mm)

To connect the pipe after installation of the unit (figure)

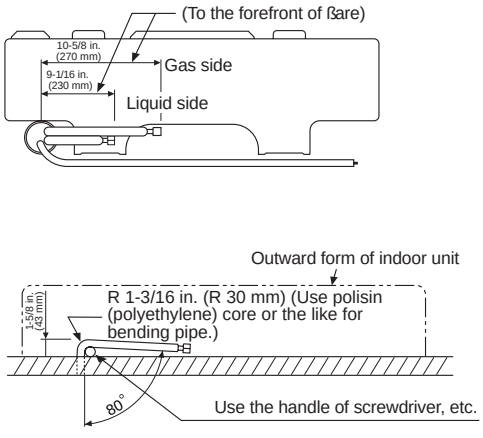


Fig. 10-3-17

NOTE :

If the pipe is incorrectly bent, the indoor unit may be unstable on the wall.

After passing the connecting pipe through the pipe hole, connect the connecting pipe to the auxiliary pipes and wrap the facing tape around them.

CAUTION

- Bind the auxiliary pipes (two) and connecting cable with facing tape tightly.

  In case of leftward piping and rear-leftward piping, bind the auxiliary pipes (two) only with facing tape.

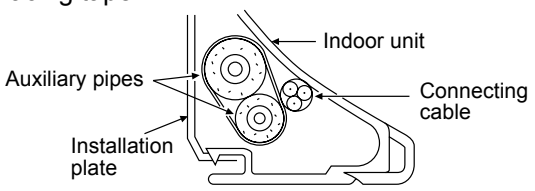


Fig. 10-3-18

- Carefully arrange the pipes so that none of the pipes stick out of the rear plate of the indoor unit.
- Carefully connect the auxiliary pipes and connecting pipes to each other and cut off the insulating tape wound on the connecting pipe to avoid double-taping at the joint, moreover, seal the joint with the vinyl tape, etc.
- Since condensation can result in machine performance trouble, be sure to insulate both connecting pipes. (Use polyethylene foam as insulating material.)
- When bending a pipe, be careful not to crush it.

10-3-6. Indoor Unit Installation

1. Pass the pipe through the hole in the wall, and hook the indoor unit on the installation plate at the upper hooks.
2. Swing the indoor unit to right and left to confirm that it is firmly hooked on the installation plate.
3. While pressing the indoor unit onto the wall, hook it at the lower part on the installation plate.
   Pull the indoor unit toward you to confirm that it is firmly hooked on the installation plate.

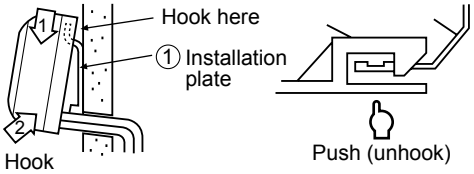


Fig. 10-3-19

- For detaching the indoor unit from the installation plate pull the indoor unit toward you while pushing the bottom up at the specified places.

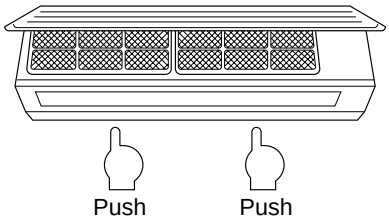


Fig. 10-3-20

10-3-7. Drainage

1. Run the drain hose at a downward sloped angle.

NOTE :

- Hole should be made at a slight downward slant on the outdoor side.

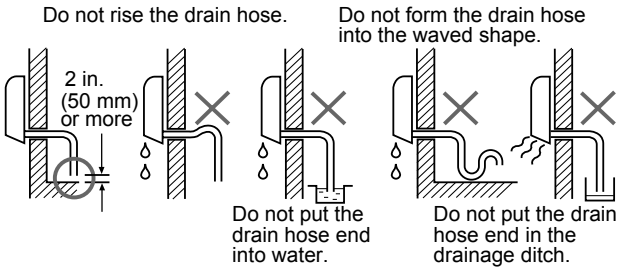


Fig. 10-3-21

2. Put water in the drain pan and make sure that the water is being drained outside.
3. When connecting extension drain hose, insulate the connection part of extension drain hose with shield pipe.

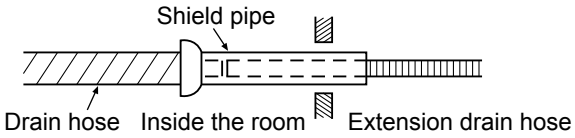


Fig. 10-3-22

CAUTION

Install the drain pipe for proper drainage.

Improper drainage can result in water dripping inside the room.

This air conditioner has been designed to drain water collected from condensation which forms on the back of the indoor unit, to the drain pan.

Therefore, do not locate the power cord and other parts at a high place than the drain guide.

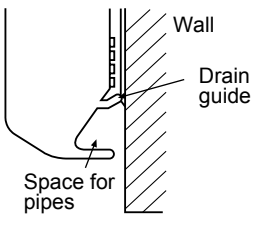


Fig. 10-3-23

10-4. Outdoor Unit

10-4-1. Installation Location

- A location which provides enough space around the outdoor unit as shown in the diagram.
- A location which can bear the weight of the outdoor unit and does not allow an increase in noise level and vibration.
- A location where the operation noise and discharged air do not disturb neighbors.
- A location which is not exposed to a strong wind.
- A location free of combustible gases.
- A location which does not block a passage.
- A location where the drain water does not cause any problems.
- Depending on snow level, use a field fabricated ice or snow stand.
- When the outdoor unit is to be installed in an elevated position, be sure to secure its feet.

Precautions for adding refrigerant

- Use a scale having a precision with at least 10 g per index line when adding the refrigerant.

  Do not use a bathroom scale or similar instrument.
- Use liquid refrigerant when refilling the refrigerant. Since the refrigerant is in liquid form, it can fill quickly.

  Therefore, perform the filling operation carefully and insert the refrigerant gradually.

CAUTION

1. Install the outdoor unit without anything blocking the discharging air.
2. When the outdoor unit is installed in a place always exposed to strong winds like on the coast or on a high story of a building, secure the normal fan operation using a duct or a wind shield.
3. Especially in windy areas, install the unit to prevent the admission of wind.
4. Installation in the following places may result in trouble.

   Do not install the unit in such places.
   - A place full of machine oil.
   - A saline-place such as the coast.
   - A place full of sulfide gas.
   - A place where high-frequency waves are likely to be generated, such as from audio equipment, welders, and medical equipment.

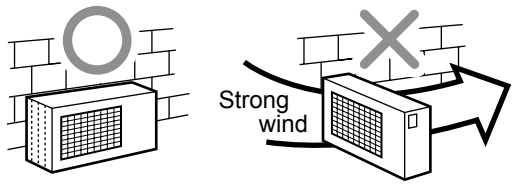


Fig. 10-4-1

10-4-2. Refrigerant Piping Connection

Flaring

1. Make sure you have enough pipe to reach indoor unit.
2. Cut the pipe with a pipe cutter.

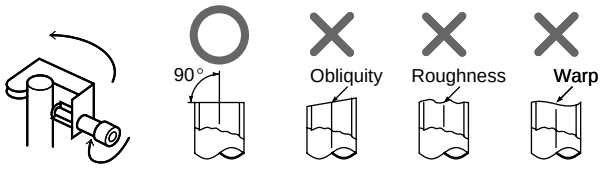


Fig. 10-4-2

3. Insert a flare nut into the pipe and flare the pipe.

Tightening connection

Align the centers of the connecting pipes and tighten the flare nut as far as possible with your fingers. Then tighten the nut with a two wrenches as show below.

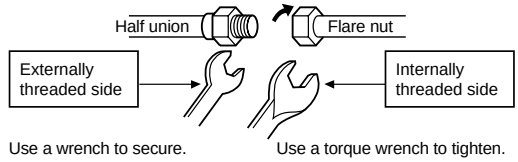


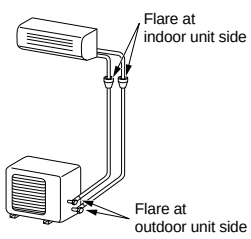
Fig. 10-4-3

CAUTION

Do not apply excess torque. Otherwise, the nut may crack depending on the conditions.

Outer dia. of copper pipe	Tightening torque
Ø1/4 in. (Ø6.35 mm)	10 to 13 lbf.ft (14 to 18 N·m)
Ø3/8 in. (Ø9.52 mm)	24 to 31 lbf.ft (33 to 42 N·m)
Ø1/2 in. (Ø12.70 mm)	37 to 46 lbf.ft (50 to 62 N·m)

- Tightening torque for connection of flare pipe
  The pressure of R410A is higher than R22. (Approx. 1.6 times.) Therefore securely tighten the flare pipes which connect the outdoor unit and the indoor unit with the specified tightening torque using a torque wrench.



10-4-2. Wiring Connection

NOTE

All wiring and connections must comply with NEC, CEC, local codes.

- Connect all wires to the correct terminal on the wiring terminal blocks.
- Make sure that all connectors are secure.
- Size connectors per the ratings listed in the system requirement section.
- System interconnections should be minimum AWG14.

1. MOUNT THE OUTDOOR UNIT POWER DISCONNECT.
2. ROW POWER WIRING FROM MAIN BOX TO DISCONNECT PER NEC AND LOCAL CODES.
3. Remove the valve cover and the cord clamp from the outdoor unit.
4. Fix conduit connector to conduit plate by lock nut and secure it tightly. Connect the power supply and connecting cables to the terminal block as shown in figure and secure it tightly with screws.
5. You should not have extra cables.
6. Secure the power cord and the connceting cable with the cord clamp.
7. Attach the electric parts cover and the valve cover on the outdoor unit.
8. RUN PIPING AND INTERCONNECTING CABLE TO THE INDOOR UNIT.

10-4-3. Electrical Work

WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

The unit cabinet must have an uninterrupted or unbroken ground to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metal conduit when installed in accordance with existing electrical codes.

Before performing service or maintenance, be sure main power switch is turned OFF.

CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage or improper operation.

Unit failure as a result, or operation on improper line voltage or excessive phase imbalance constitutes abuse and may cause damage to electrical components. Such operation could void any applicable warranty.

1. The supply voltage must be the same as the rated voltage of the air conditioner.
2. Prepare the power source for exclusive use with the air conditioner.

NOTE : Power supply cord
- Wire type : minimum AWG14

Stripping length of the Power supply cord and Inter connecting cable

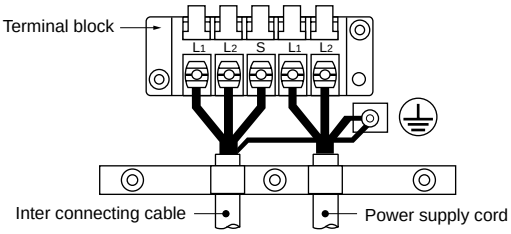


Fig. 10-4-4

Unit : inch (mm)

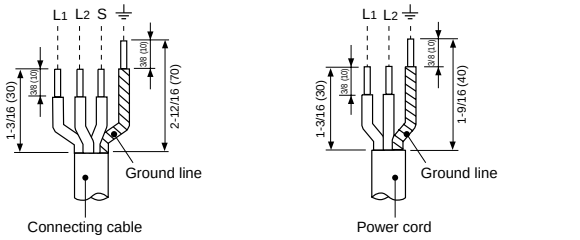


Fig. 10-4-5

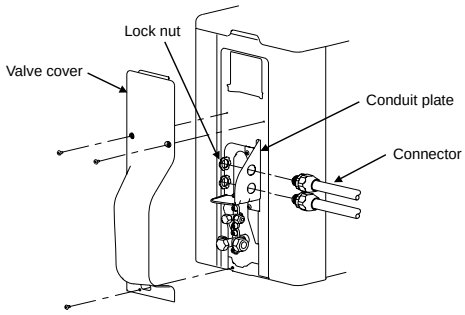


Fig. 10-4-6

CAUTION

- Wrong wiring connection may cause some electrical parts burn out.
- Be sure to comply with LOCAL CODES.
- Every wire must be connected firmly.
- If incorrect or incomplete wiring is carried out, it will cause an ignition or smoke.

NOTE : Inter connecting cable
- Wire type : minimum AWG14

10-5. EVACUATING

10-5-1. Evacuating

After the piping has been connected to the indoor unit, you can perform vacuuming together at once.

Vacuuming

Evacuate the air in the connecting pipes and in the indoor unit using a vacuum pump. Do not use the refrigerant in the outdoor unit. For details, see the manual of the vacuum pump.

Using a vacuum pump

Be sure to use a vacuum pump with counter-flow prevention function so that inside oil of the pump does not flow backward into pipes of the air conditioner when the pump stops.
(If oil inside of the vacuum pump enters the air conditioner, which use R410A, refrigeration cycle trouble may happen.)

1. Connect the charge hose from the manifold valve to the service port of the packed valve at gas side.
2. Connect the charge hose to the port of the vacuum pump.
3. Open fully the low pressure side handle of the gauge manifold valve.
4. Operate the vacuum pump to start evacuating. Perform evacuating for about 15 minutes if the piping length is 66 feet (20 m). (15 minutes for 66 feet) (assuming a pump capacity of 27 liters per minute) Then confirm that the compound pressure gauge reading is -101 kPa (-76 cmHg).
5. Close the low pressure side valve handle of the gauge manifold valve.
6. Open fully the valve stem of the packed valves (both gas and liquid sides).
7. Remove the charging hose from the service port.
8. Securely tighten the caps on the packed valves.

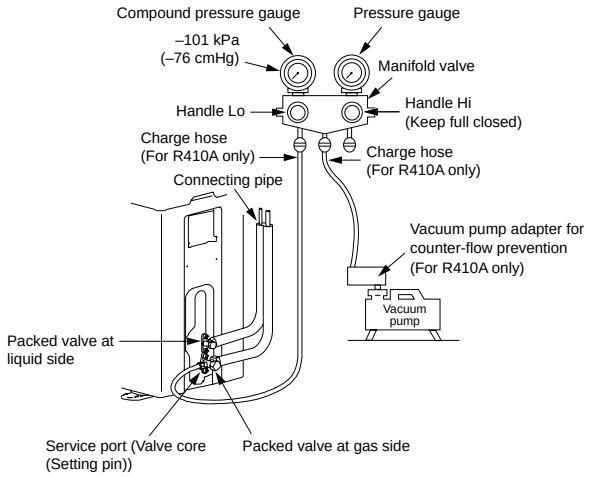


Fig. 10-5-1

CAUTION

- **KEEP IMPORTANT 5 POINTS FOR PIPING WORK.**
  (1) Take away dust and moisture (inside of the connecting pipes).
  (2) Tighten the connections (between pipes and unit).
  (3) Evacuate the air in the connecting pipes using a VACUUM PUMP.
  (4) Check gas leak (connected points).
  (5) Be sure to fully open the packed valves before operation.
- **UNIT DAMAGE HAZARD**
  Failure to follow this caution may result in equipment damage or improper operation.
  Never use the system compressor as a vacuum pump.

10-5-2. Packed valve handling precautions

- Open the valve stem until it touches the stopper. Once it is in contact with the stopper, refrain form applying any more force than is necessary.
- Securely tighten the valve stem cap with torque in the following table:

Gas side Ø1/2 in. (Ø12.70 mm)	37 to 46 lbf.ft (50 to 62 N·m)
Gas side Ø3/8 in. (Ø9.52 mm)	24 to 31 lbf.ft (33 to 42 N·m)
Liquid side Ø1/4 in. (Ø6.35 mm)	10 to 13 lbf.ft (14 to 18 N·m)
Service port	10 to 13 lbf.ft (14 to 18 N·m)

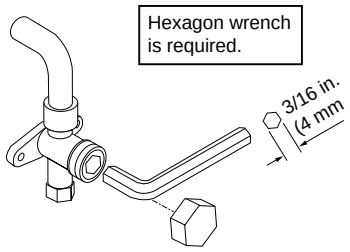


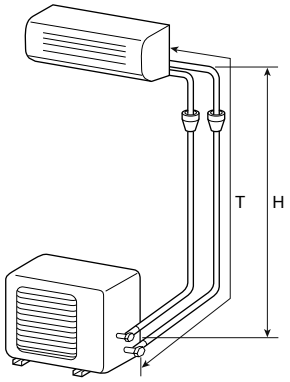
Fig. 10-5-2

10-6. SYSTEM REQUIREMENTS

10-6-1. Piping (Field supplied)

- Minimum refrigerant line length between the outdoor unit and indoor unit is 6.6ft. (2m).
- Maximum pipe lengths

Allowable Pipe length T (ft (m))	Height difference (Indoor – Outdoor H) (ft (m))
66 (20)	33 (10)



Refrigerant pipe sizes

Liquid side		Gas side		
Outer Diameter In. (mm)	Thickness In. (mm)	Outer diameter In. (mm)		Thickness In. (mm)
		(09, 12LKV)	(15, 17, 22LKV)	
Ø1/4 (6.35)	0.03 (0.8)	Ø3/8 (9.52)	Ø1/2 (12.70)	0.03 (0.8)

Insulation

Both lines need to be insulated. Use a minimum 5/16 in (8mm) wall thickness.

Refrigerant charge

Unit : ft (mm)

Refrigerant charge Length of refrigerant Pipe connected to Indoor/ outdoor unit	Additional refrigerant
6.6-50 (2-15m)	None
50-66 (15-20m)	Add 0.22oz/ft (20g/m) of Refrigerant for piping that exceeds 50ft (15m) up to 66ft (20m)

* Caution during addition of refrigerant Max. amount of additional refrigerant is 0.22 lbs (100g).
Charge the refrigerant accurately. Overcharging may cause serious trouble with the compressor.

* Minimum refrigerant pipe is 6.6ft (2m).
Using pipe shorter than that may cause a malfunction of the compressor or other devices.

10-6-2. Power supply Connection and Connecting Cable

- The power supply shall be connected to the outdoor unit by 3 wires.
- The connecting cable between the indoor unit and outdoor unit is 4 wires.
  This cable provides the power for the indoor unit and the communication signal between the outdoor unit and indoor unit.
- Consult local building codes, NEC (National Electrical Code) or CEC (Canadian Electrical Code) for special requirements.
- The following are the electrical requirements.

Item \ Product Model			
	FCU	RAS-09LKV-UL	RAS-12LKV-UL
	CDU	RAS-09LAV-UL	RAS-12LAV-UL
Max. Current.		8.5A	13.0A
Fuse / Circuit Breaker of main power supply		15A	
Power supply cord (Not provide)	Connect to FCU/CDU	CDU	
	No. of Core	3 (L1, L2, ≒)	
	Size	AWG14	
Inter connecting cable between FCU & CDU (Not provide)	No. of Core	4 (L1, L2, S,≒)	
	Size	AWG14	

10-7. OTHERS

10-7-1. Gas Leak Test

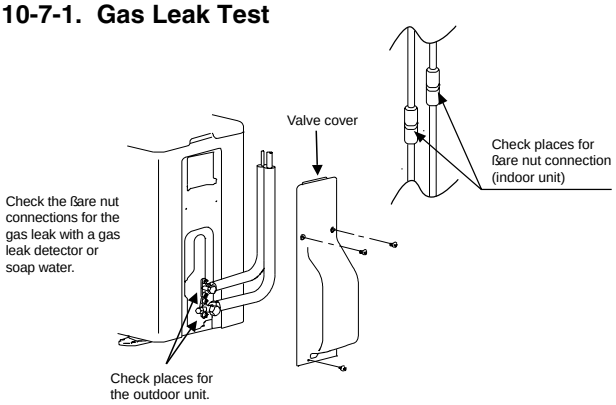


Fig. 10-7-1

10-7-2. Test Operation

To switch the TEST RUN (COOL) mode, press RESET button for 10 seconds. (The beeper will make a short beep.)

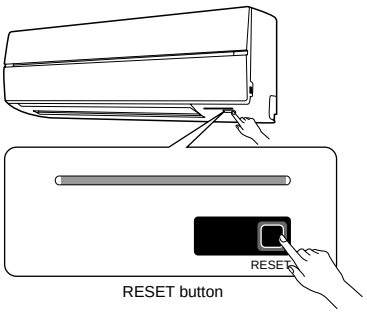


Fig. 10-7-2

10-7-3. Auto Restart Setting

This product is designed so that, after a power failure, it can restart automatically in the same operating mode as before the power failure.

Information

The product was shipped with Auto Restart function in the on position. Turn it off as required.

10-7-4. How to cancel the Auto Restart

1. Press and hold the RESET button on the indoor unit for 3 seconds to cancel the operation. (3 beep sound but OPERATION lamp does not blink)
2. Press and hold the RESET button on the indoor unit for 3 seconds to set the operation. (3 beep sound and OPERATION lamp blink 5 time/sec for 5 seconds)
   · Do not operate ON timer and OFF timer3

Note : Default setting of auto restart operation is OK

10-7-5. Remote Controller A or B Selection Setting

When two indoor units are installed in the separated rooms, it is not necessary to change the selector switches.

Remote controller A or B selection

- When two indoor units are installed in the same room or adjacent two rooms, if operating a unit, 2 units may receive the remote controller signal simultaneously and operate. In this case, the operation can be preserved by setting either one indoor unit or remote controller to B setting. (Both are set to A setting in factory shipment.)
- The remote controller signal is not received when the settings of indoor unit and remote controller are different.
- There is no relation between A setting/B setting and A room/B room when connecting the piping and cables.

Remote controller A- B selection

To separate using of remote controller for each indoor unit in case of 2 air conditioner are installed nearly.

Remote controller B Setup.

1. Push RESET button on the indoor unit to turn the air conditioner ON.
2. Point the remote controller at the indoor unit.
3. Push and hold CHK button on the remote controller by the tip of the pencil.
   “00” will be shown on the display.
4. Push MODE during pushing CHK, “B” will show on the display and “00” will disappear and the air conditioner will turn OFF.
   The remote controller B is memorized.

Note :

1. Repeat above step to reset Remote Controller to be A.
2. Remote controller A have not “A” display.
3. Detault setting of remote controller from factory is A.

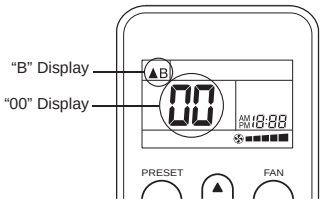


Fig. 10-5-1

Temperature unit °F - °C selection

1. Push and hold CHK • button on the Remote Control by the tip of the pencil, "00" will be shown on the display.
2. Press (SLEEP) during pushing CHK •

Note :

1. Repeat above step to reset Remote Controller to be °F.
2. Operation mode and temperature set will reset to initial setting after change the temperature unit.
3. Default setting of Remote Control from factory is °F.

11. HOW TO DIAGNOSE THE TROUBLE

The pulse motor circuits are mounted to both indoor and outdoor units. Therefore, diagnose troubles according to the trouble diagnosis procedure as described below. (Refer to the check points in servicing written on the wiring diagrams attached to the indoor/outdoor units.)

Table 11-1

No.	Troubleshooting Procedure	Page
1	First Confirmation	62
2	Primary Judgment	63
3	Judgment by Flashing LED of Indoor Unit	63
4	Self-Diagnosis by Remote Controller	64
5	Judgment of Trouble by Every Symptom	67

No.	Troubleshooting Procedure	Page
6	How to Check Simply the Main Parts	72
7	Troubleshooting	73
8	How to Diagnose Trouble in Outdoor Unit	75
9	How to Check Simply the Main Parts	76
10	How to Simply Judge Whether Outdoor Fan Motor is Good or Bad	81

◆ Precautions when handling the new inverter (3DV Inverter)

⚠ CAUTION: HIGH VOLTAGEN

The high voltage circuit is incorporated.

Be careful to do the check service, as the electric shock may be caused in case of touching parts on the P.C. board by hand.

The new inverter (3DV inverter) will be incorporated starting with this unit.

(3DV: 3-shunt Discrete Vector control)

◆ The control circuitry has an uninsulated construction.

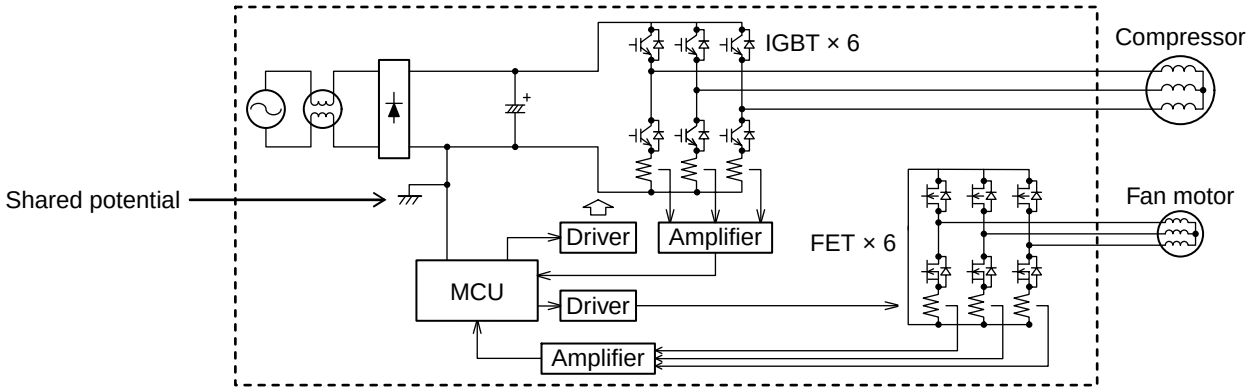


Fig. 11-1

⚠ CAUTION

A high voltage (equivalent to the supply voltage) is also energized to ground through the sensors, PMV and other low-voltage circuits. The sensor leads and other wires are covered with insulated tubes for protection. Nevertheless, care must be taken to ensure that these wires are not pinched.

Take sufficient care to avoid directly touching any of the circuit parts without first turning off the power.

At times such as when the circuit board is to be replaced, place the circuit board assembly in a vertical position.

Laying the board flat on an electrically conductive object (such as the top panel of the air conditioner's outdoor unit) while a charge is still retained by the electrolytic capacitors of the inverter's main circuit may cause short-circuiting between the electrolytic capacitors and secondary circuit components and result in damage to the components.

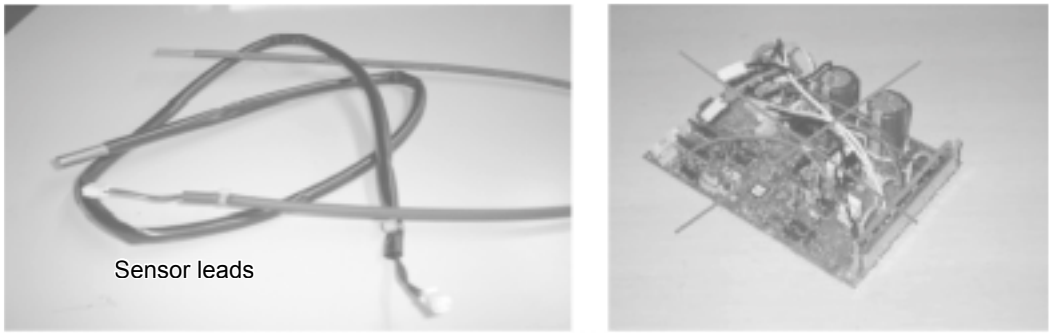


Fig. 11-2

Do NOT lay the circuit board assembly flat.

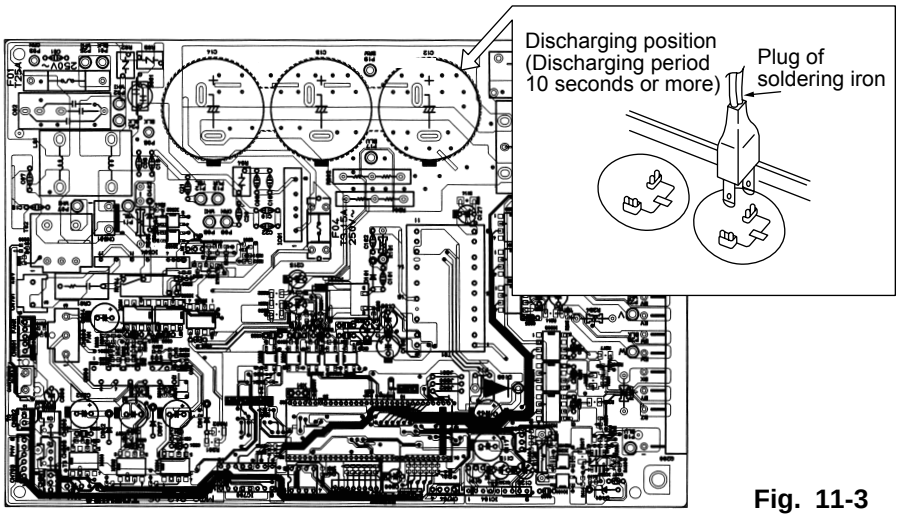
◆ Precautions when inspecting the control section of the outdoor unit

NOTE :

A large-capacity electrolytic capacitor is used in the outdoor unit controller (inverter). Therefore, if the power supply is turned off, charge (charging voltage DC265 to 360V) remains and discharging takes a lot of time. After turning off the power source, if touching the charging section before discharging, an electrical shock may be caused. Discharge the electrolytic capacitor completely by using soldering iron, etc.

< Discharging method >

1. Remove the inverter cover (plating) by opening four mounting claws.
2. As shown below, connect the discharge resistance (approx. 100Ω40W) or plug of the soldering iron to voltage between + – terminals of the C14 (“CAUTION HIGH VOLTAGE” is indicated.) electrolytic capacitor (500μF/400V) on P.C. board, and then perform discharging.



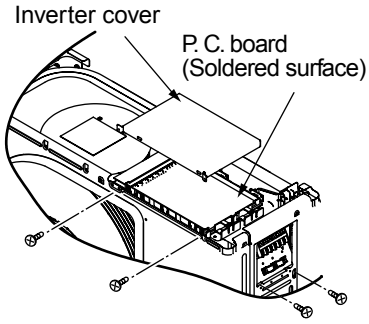


Fig. 11-3

11-1. First Confirmation

11-1-1. Confirmation of Power Supply

Confirm that the power breaker operates (ON) normally.

11-1-2. Confirmation of Power Voltage

Confirm that power voltage is AC 208–230 ± 10%.

If power voltage is not in this range, the unit may not operate normally.

11-1-3. Operation Which is not a Trouble (Program Operation)

For controlling the air conditioner, the program operations are built in the microcomputer as described in the following table.

If a claim is made for running operation, check whether or not it meets to the contents in the following table.

When it does, we inform you that it is not trouble of equipment, but it is indispensable for controlling and maintaining of air conditioner.

Table 11-1-1

No.	Operation of air conditioner	Description
1	When power breaker is turned “ON”, the operation indicator (Green) of the indoor unit flashes.	The OPERATION lamp of the indoor unit flashes when power source is turned on. If [⏻] button is operated once, flashing stops. (Flashes also in power failure)
2	Compressor may not operate even if the room temperature is within range of compressor-ON.	The compressor does not operate while compressor restart delay timer (3-minutes timer) operates. The same phenomenon is found after power source has been turned on because 3-minutes timer operates.
3	In Dry and ECO mode, FAN (air flow) display does not change even though FAN (air flow select) button is operated.	The air flow indication is fixed to [AUTO].
4	Increasing of compressor motor speed stops approx. 30 seconds after operation started, and then compressor motor speed increases again approx. 30 seconds after.	For smooth operation of the compressor, the compressor motor speed is restricted to Max. 41 rps for 2 minutes, and Max.91 rps for 2 minutes to 3 minutes, respectively after the operation has started.
5	In AUTO mode, the operation mode is changed.	After selecting Cool or Heat mode, select an operation mode again if the compressor keeps stop status for 15 minutes.
6	In HEAT mode, the compressor motor speed does not increase up to the maximum speed or decreases before the temperature arrives at the set temperature.	The compressor motor speed may decrease by high-temp. release control (Release protective operation by temp.-up of the indoor heat exchanger) or current release control.

11-2. Primary Judgment

To diagnose the troubles, use the following methods.

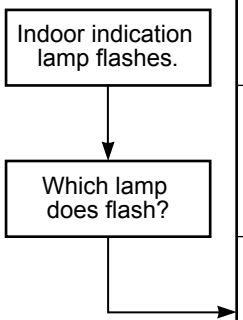
1) Judgment by flashing LED of indoor unit
2) Self-diagnosis by service check remote controller
3) Judgment of trouble by every symptom

Firstly use the method 1) for diagnosis. Then, use the method 2) or 3) to diagnose the details of troubles.

11-3. Judgment by Flashing LED of Indoor Unit

While the indoor unit monitors the operation status of the air conditioner, if the protective circuit operates, the contents of self-diagnosis are displayed with block on the indoor unit indication section.

Table 11-3-1



Item	Check code	Block display	Description for self-diagnosis
A	—	OPERATION (Green) Flashing display (1 Hz)	• When turn ON power supply. • Power supply ON after failure or OFF. • This flashing display is not air conditioner failure.
B	00	OPERATION (Green) Flashing display (5 Hz)	Protective circuit operation for indoor P.C. board
C	01	OPERATION (Green) TIMER (Yellow) Flashing display (5 Hz)	Protective circuit operation for connecting cable and serial signal system
D	02	OPERATION (Green) FILTER (Orange) Flashing display (5 Hz)	Protective circuit operation for outdoor P.C. board
E	03	OPERATION (Green) TIMER (Yellow) FILTER (Orange) Flashing display (5 Hz)	Protective circuit operation for others (including compressor)

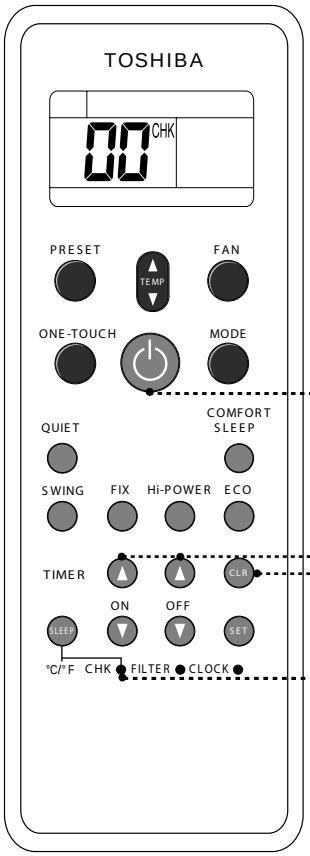
NOTES :

1. Some check code will flash display of the indoor unit, when the air conditioner operates with some limitation.
2. Some check code will flash display of the indoor unit and stop operation of the air conditioner.
3. When item B and C or item B and apart of item E occur concurrently, priority is given to the block of item B.
4. The check codes can be confirmed on the remote controller for servicing.

11-4. Self-Diagnosis by Remote Controller (Check Code)

1. If the lamps are indicated as shown B to E in Table 11-3-1, execute the self-diagnosis by the remote controller.
2. When the remote controller is set to the service mode, the indoor controller diagnoses the operation condition and indicates the information of the self-diagnosis on the display of the remote controller with the check codes. If a fault is detected, all lamps on the indoor unit will flash at 5Hz and it will beep for 10 seconds (Beep, Beep, Beep ...). The timer lamp usually flashes (5Hz) during self-diagnosis.

11-4-1. How to Use Remote Controller in Service Mode



Alphanumeric characters are used for the check codes.

5 is 5. 6 is 6.
A is A. b is B.
C is C. d is D.

1 **Press [CHECK] button with a tip of pencil to set the remote controller to the service mode.**

- " 00 " is indicated on the display of the remote controller.

2 **Press [ON▲] or [OFF▲] button**

If there is no fault with a code, the indoor unit will beep once (Beep) and the display of the remote controller will change as follows :

00 → 01 → 02 ··· 1d → 1E → 33

- The TIMER indicator of the indoor unit flashes continuously. (5 times per 1 sec.)
- Check the unit with all 52 check codes (00 to 33) as shown in Table-11-4-1.
- Press [ON▼] or [OFF▼] button to change the check code backward.

If there is a fault, the indoor unit will beep for 10 seconds (Beep, Beep, Beep...).

Note the check code on the display of the remote controller.

- 2-digits alphanumeric will be indicated on the display.
- All indicators on the indoor unit will flash. (5 times per 1 sec.)

3 **Press [CLR] button. After service finish for clear** service code in memory.

- "7F" is indicated on the display of the remote control.

4 **Press [⏻] button to release the service mode.**

- The display of the remote controller returns to as it was before service mode was engaged.

Fig. 11-4-1

11-4-2 Caution at Servicing

1. After using the service mode of remote controller finished, press the [⏻] button to reset the remote controller to normal function.
2. After finished the diagnosis by the remote controller, turn OFF power supply and turn its ON again to reset the air conditioner to normal operation. However, the check codes are not deleted from memory of the microcomputer.
3. After servicing finished, press [CLR] button of remote controller under service mode status to send code "7F" to the indoor unit. The check code stored in memory is cleared.

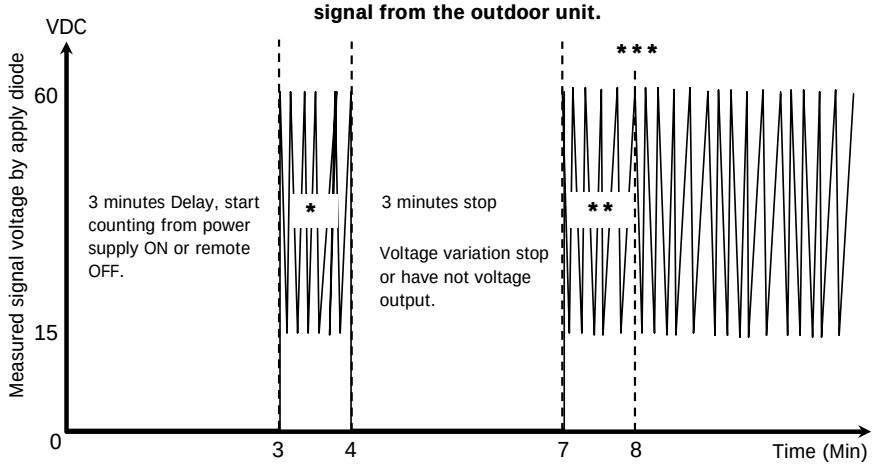
Table 11-4-1

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
00	Indoor P.C. board.	0C	TA sensor ; The room temperature sensor is short-Circuit or disconnection.	Operation continues.	Flashes when error is detected.	1. Check the sensor TA and connection. 2. In case of the sensor and its connection is normal, check the P.C. board.
		0d	TC sensor ; The heat exchanger temperature sensor of the indoor unit is out of place, disconnection, short-circuit or migration.	Operation continues.	Flashes when error is detected.	1. Check the sensor TC and connection. 2. In case of the sensor and its connection is normal, check the P.C. board.
		11	Fan motor of the indoor unit is failure, lock-rotor, short-circuit, disconnection, etc. Or its circuit on P.C. board has problem.	All OFF	Flashes when error is detected.	1. Check the fan motor and connection. 2. In case of the motor and its connection is normal, check the P.C. board.
		12	Other trouble on the indoor P.C. board.	Depend on cause of failure.	Depend on cause of failure.	Replace P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
01	Serial signal and connecting cable.	04	1) Defective wiring of the connecting cable or miss-wiring. 2) Operation signal has not send from the indoor unit when operation start. 3) Outdoor unit has not send return signal to the indoor unit when operation started. 4) Return signal from the outdoor unit is stop during operation. • Some protector (hardware, if exist) of the outdoor unit open circuit of signal. • Signal circuit of indoor P.C. board or outdoor P.C. board is failure in some period.	Indoor unit operates continue. Outdoor unit stop.	Flashes when error is detected. Flashing stop and outdoor unit start to operate when the return signal from the outdoor unit is normal.	1) to 3) The outdoor unit never operate. • Check connecting cable and correct if defective wiring. • Check 25A fuse of inverter P.C. board. • Check 3.15A fuse of inverter P.C. board. • Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 (or L2 and S) If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board. 4) The outdoor unit abnormal stop at some time. • If the other check codes are found concurrently, check them together. • Check protector (hardware) such as Hi-Pressure switch, Thermal-Relay, etc. • Check refrigerant amount or any possibility case which may caused high temperature or high pressure. • Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 (or L2 and S) If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board.

Note : Operation signal of the indoor unit shall be measured in the sending period as picture below.

Sending signal of the indoor unit when have not return signal from the outdoor unit.



* Signal send only 1 minute and stop. Because of return signal from outdoor unit has not received.

** Signal resend again after 3 minutes stop. And the signal will send continuously.

*** 1 minute after resending, the indoor unit display flashes error.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
02	Outdoor P.C. board	14	Current on inverter circuit is over limit in short time. ● Inverter P.C. board is failure, IGBT shortage, etc. ● Compressor current is higher than limitation, lock rotor, etc.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operate but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure 3-Phase output of inverter P.C. board (150-270VAC) at the connecting lead wire of compressor. 4. If 3-Phase output is abnormal, replace inverter P.C.Board. 5. If 3-Phase output is normal, replace compressor. (lock rotor, etc.)
		16	Compressor position-detect circuit error or short-circuit between winding of compressor.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operation but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure resistance of compressor winding. If circuit is shortage, replace the compressor.
		17	Current-detect circuit of inverter P.C. board error.	All OFF	Flashes after error is detected 4 times*.	Even if trying to operate again, all operations stop, replace inverter P.C. board.
		18	TE sensor ; The heat exchanger temperature sensor of the outdoor unit either TS sensor ; Suction pipe temperature sensor, out of place, disconnection or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TE, TS and connection. 2. In case of the sensors and its connection is normal, check the inverter P.C. board.
		19	TD sensor ; Discharge pipe temperature sensor is disconnection or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TD and connection. 2. In case of the sensor and its connection is normal, check the inverter P.C. board.
		1A	Outdoor fan failure or its drive-circuit on the inverter P.C. board failure.	All OFF	Flashes after error is detected 4 times*.	1. Check the motor, measure winding resistance, shortage or lock rotor. 2. Check the inverter P.C. board.
		1b	TO sensor ; The outdoor temperature sensor is disconnection or shortage.	Operation continues.	Record error after detected 4 times*. But does not flash display.	1. Check sensors TO and connection. 2. In case of the sensor and its connection is normal, check the inverter P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
		1C	Compressor drive output error. (Relation of voltage, current and frequency is abnormal) ● Overloading operation of compressor caused by over-charge refrigerant, P.M.V. failure, etc. ● Compressor failure (High current).	All OFF	Flashes after error is detected 4 times*.	1. Check installation conditions such as packed valve opening, refrigerant amount and power supply (rate ±10%, both of operation and non operation condition). 2. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 3. Observe any possibility cause which may affect operation load of compressor. 4. Operate again. If compressor operation is failure when 20 seconds passed (count time from operation starting of compressor), replace compressor.
	* 4 times ; When first error is detected, error is count as 1 time, then once operation is stop and re-started. After re-starting operation within 6 minutes, if same error is detected, error count is add (count become 2 times) When error count comes 4 times, record error to check code. But after re-starting operation, if no error is detected and air conditioner can operate more than 6 minutes, error count is cleared.					
03	The others (including compressor)	07	Return signal of the outdoor unit has been sent when operation start. But after that, signal is stop some time. ● Instantaneous power failure. ● Some protector (hardware, if exist) of the outdoor unit open circuit of signal. ● Signal circuit of indoor P.C. board or outdoor P.C. board is failure in some period.	Indoor unit operates continue. Outdoor unit stop.	Flashes when error is detected. Flashing stop and outdoor unit start to operate when the return signal from the outdoor unit is normal.	1. Check power supply (Rate ± 10%) 2. If the air conditioner repeat operates and stop with interval of approx. 10 to 40 minutes. ● Check protector (hardware) such as Hi-Pressure switch, Thermal-Relay, etc. ● Check refrigerant amount, packed valve opening and any possibility cause which may affect high temperature or high pressure. 3. Check operation signal of the indoor unit by using diode. Measure voltage at terminal block of the indoor unit between No.2 and No.3 or L2 and S If signal is varied 15-60V continuously, replace inverter P.C. board. If signal is not varied, replace indoor P.C. board.

Block distinction		Operation of diagnosis function				Action and Judgment
Check code	Block	Check code	Cause of operation	Air conditioner status	Display flashing error	
		id	Compressor does not rotate. Because of missed wiring, missed phase or shortage.	All OFF	Flashes after error is detected 4 times*.	1. Remove connecting lead wire of the compressor, and operate again. 2. If outdoor fan does not operate or operation but stop after some period, replace the inverter P.C. board. 3. If outdoor fan operates normally, measure 3-Phase output of inverter P.C. board (150-270VAC) at the connecting lead wire of compressor. 4. If 3-Phase output is abnormal, replace inverter P.C.Board. 5. If 3-Phase output is normal, measure resistance of compressor winding. 6. If winding is shortage, replace the compressor.
		iE	Discharge temperature exceeded 117°C.	All OFF	Flashes after error is detected 4 times*.	1. Check sensors TD. 2. Check refrigerant amount. 3. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 4. Observe any possibility cause which may affect high temperature of compressor.
		iF	Compressor is high current though operation Hz is decreased to minimum limit. ● Installation problem. ● Instantaneous power failure. ● Refrigeration cycle problem. ● Compressor break down.	All OFF	Flashes after error is detected 4 times*.	1. Check installation conditions such as packed valve opening, refrigerant amount and power supply (rate ±10%, both of operation and non operation condition). 2. Check P.M.V. by measure the resistance of the coil and confirm its operation (sound of initial operation, etc.) 3. Observe any possibility cause which may affect high current of compressor. 4. If 1, 2 and 3 are normal, replace compressor.

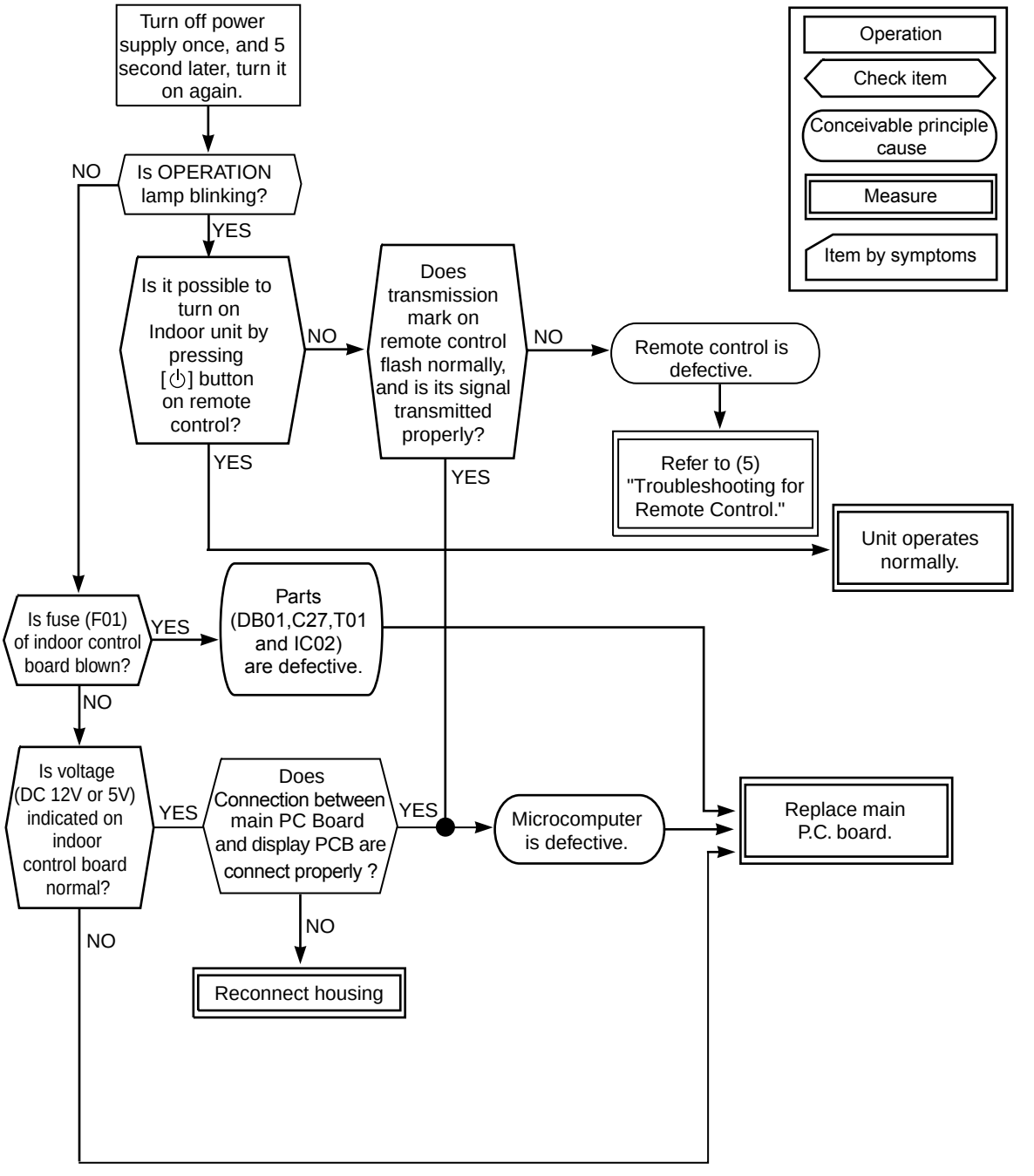
* 4 times ; When first error is detected, error is count as 1 time, then once operation is stop and re-started.
After re-starting operation within 6 minutes, if same error is detected, error count is add (count become 2 times)
When error count comes 4 times, record error to check code. But after re-starting operation, if no error is detected and air conditioner can operate more than 6 minutes, error count is cleared.

11-5. Judgement of Trouble by Every Symptom

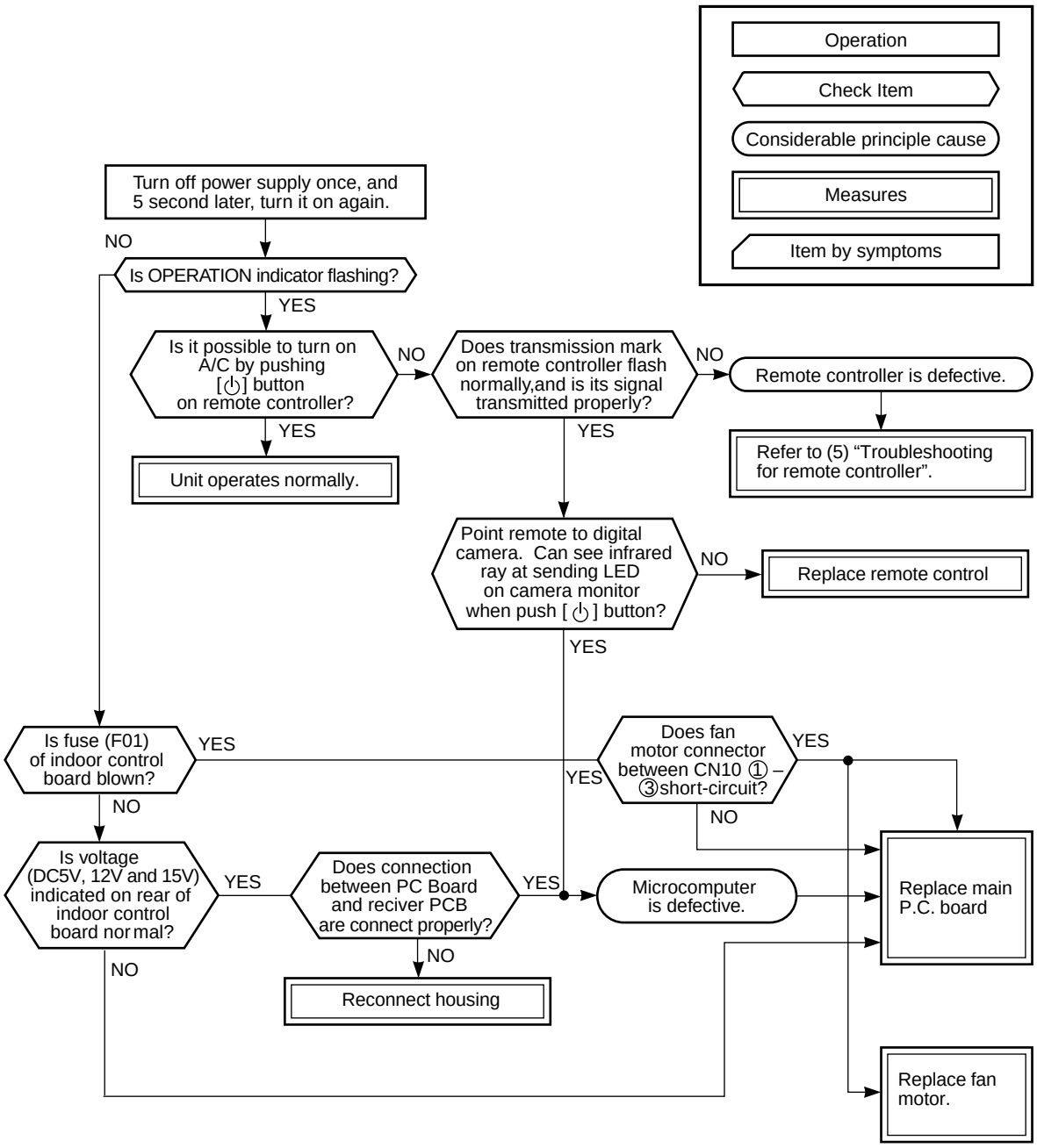
11-5-1. Indoor unit (Including remote controller)

(1) Indoor unit is not operated.

(RAS-09LKV-UL)

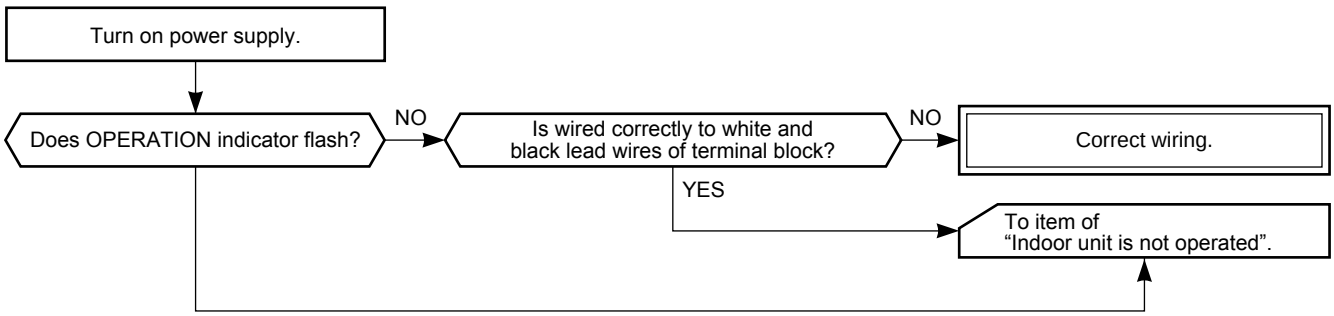


(RAS-12LKV-UL)



(2) Operation is not turned on though Indoor P.C. board is replaced

<Confirmation procedure>



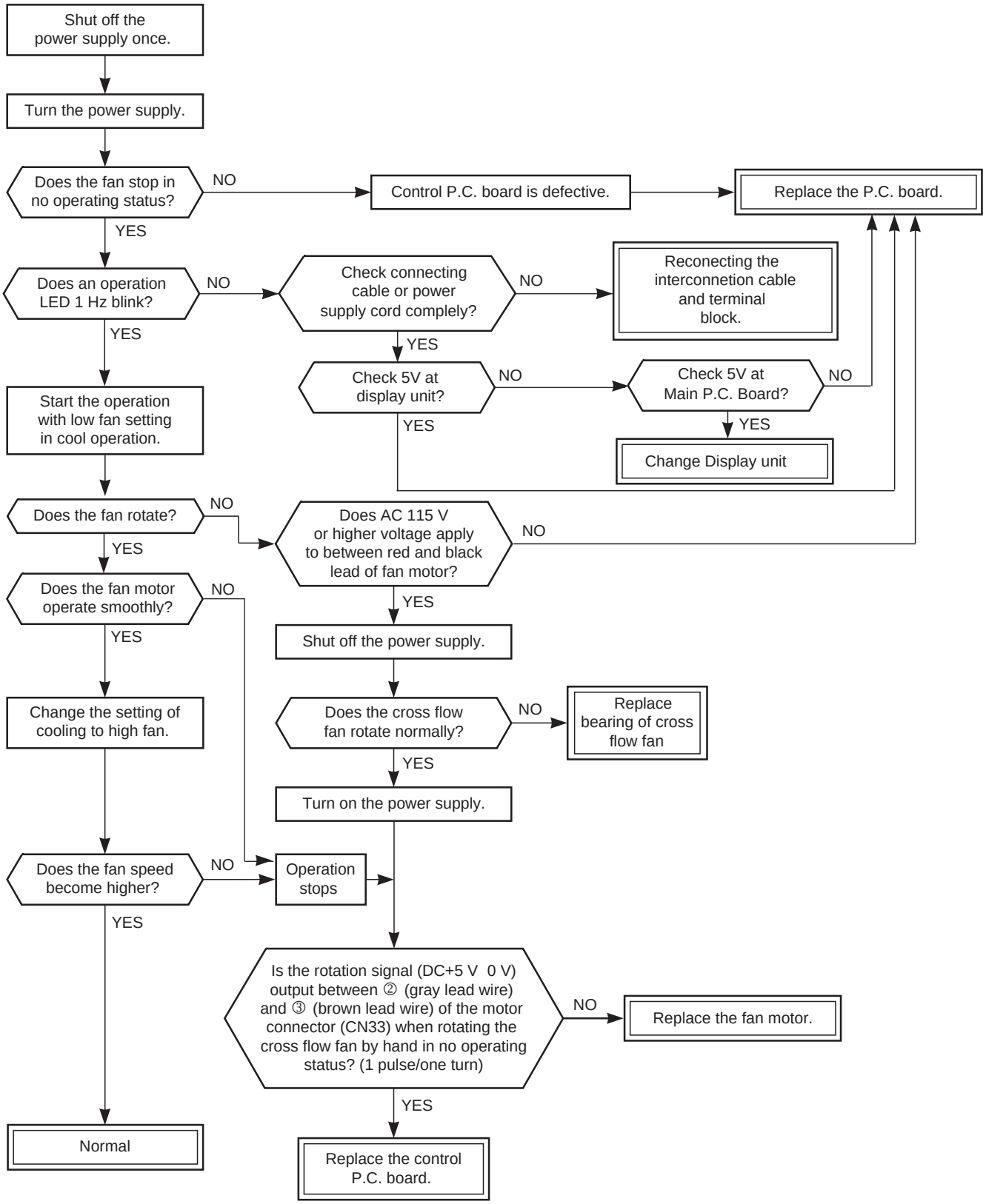
(3) Only the indoor motor fan does not operate

<Primary check>

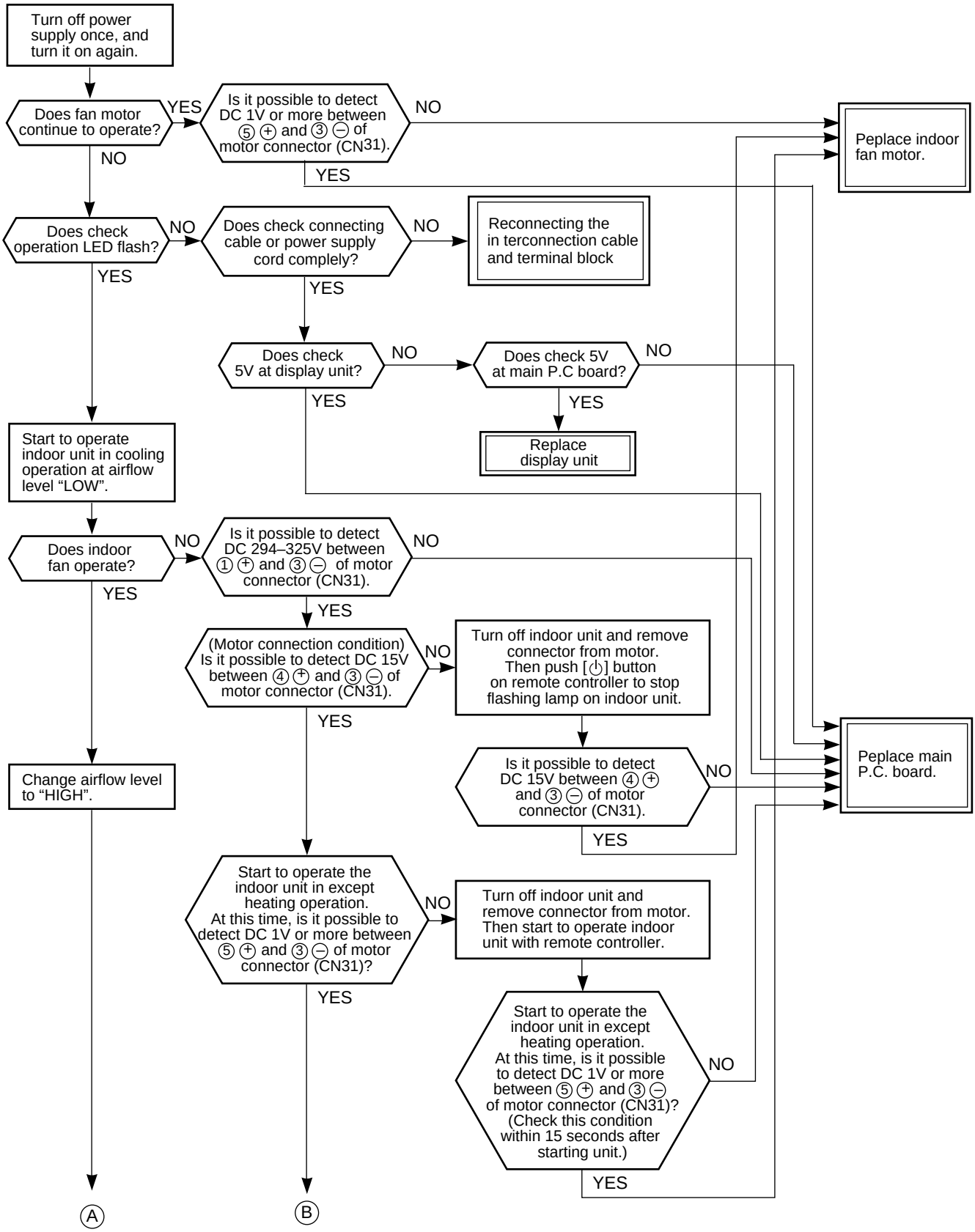
1. Is it possible to detect the power supply voltage (AC208–230V) between Ⓛ1 and Ⓛ2 on the terminal block?
2. Does the indoor fan motor operate in cooling operation?
   (In heating operation, the indoor fan motor does not operate for approximately 10 minutes after it is turned on, to prevent a cold air from blowing in.)

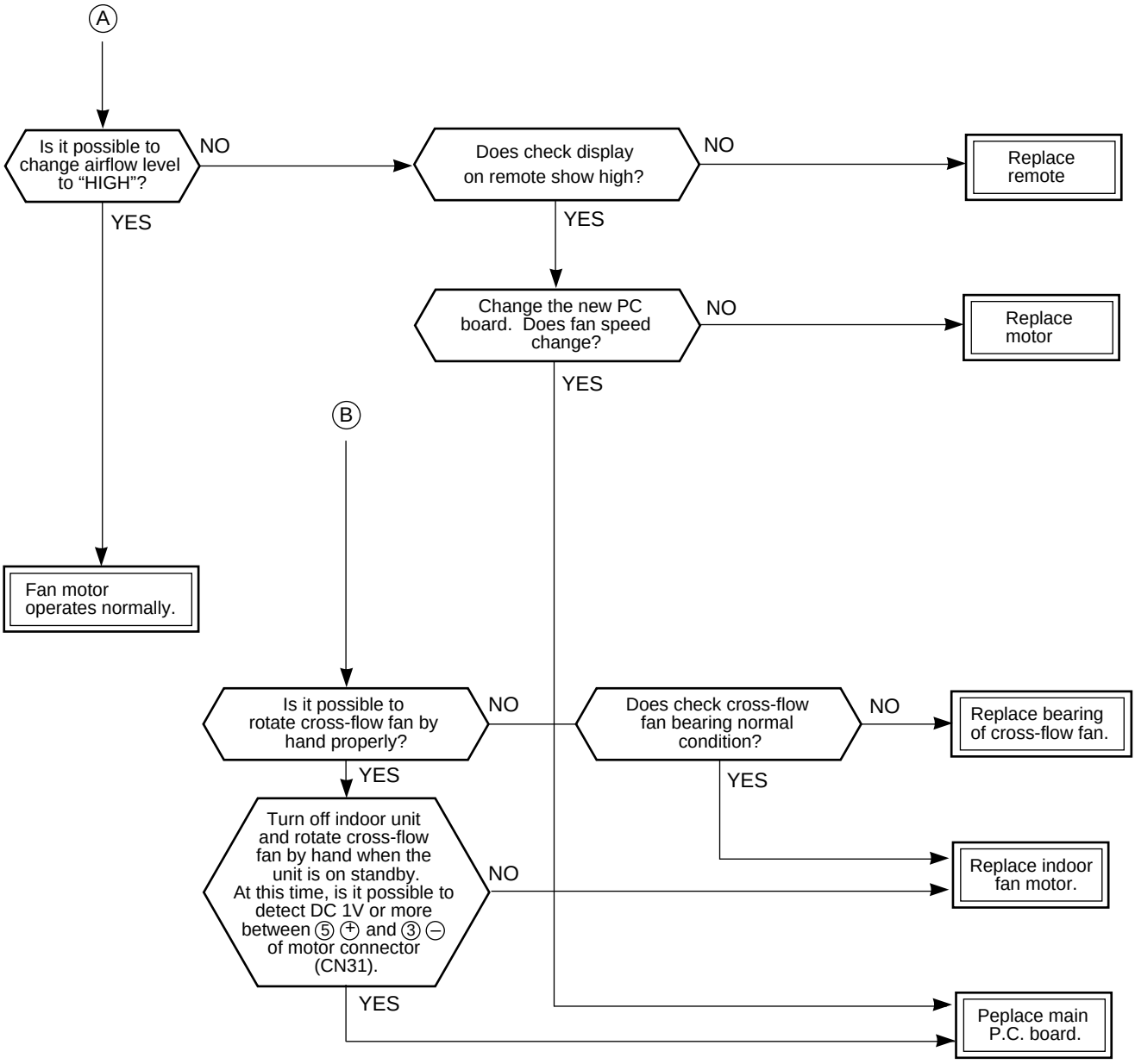
(RAS-09LKV-UL)

<Check procedure>



(RAS-12LKV-UL)


Turn off power supply once, and turn it on again.
Does fan motor continue to operate?
YES
NO
Is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Peplace indoor fan motor.
Does check operation LED flash?
NO
YES
Does check connecting cable or power supply cord complely?
NO
YES
Reconnecting the in terconnection cable and terminal block
Does check 5V at display unit?
NO
YES
Does check 5V at main P.C board?
NO
YES
Replace display unit
Start to operate indoor unit in cooling operation at airflow level “LOW”.
Does indoor fan operate?
NO
YES
Is it possible to detect DC 294–325V between ① ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
(Motor connection condition) Is it possible to detect DC 15V between ④ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Turn off indoor unit and remove connector from motor. Then push [⏻] button on remote controller to stop flashing lamp on indoor unit.
Is it possible to detect DC 15V between ④ ⊕ and ③ ⊖ of motor connector (CN31).
NO
YES
Peplace main P.C. board.
Change airflow level to “HIGH”.
Start to operate the indoor unit in except heating operation. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31)?
NO
YES
Turn off indoor unit and remove connector from motor. Then start to operate indoor unit with remote controller.
Start to operate the indoor unit in except heating operation. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31)? (Check this condition within 15 seconds after starting unit.)
NO
YES
Ⓐ
Ⓑ


A
Is it possible to change airflow level to “HIGH”?
NO
YES
Does check display on remote show high?
NO
Replace remote
YES
Change the new PC board. Does fan speed change?
NO
Replace motor
YES
Fan motor operates normally.
B
Is it possible to rotate cross-flow fan by hand properly?
NO
YES
Does check cross-flow fan bearing normal condition?
NO
Replace bearing of cross-flow fan.
YES
Turn off indoor unit and rotate cross-flow fan by hand when the unit is on standby. At this time, is it possible to detect DC 1V or more between ⑤ ⊕ and ③ ⊖ of motor connector (CN31).
NO
Replace indoor fan motor.
YES
Peplace main P.C. board.

(4) Indoor fan motor automatically starts to rotate by turning on power supply

(For AC fan motor in RAS-09LKV-UL)

<Cause>

AC motor is only coil and Hall-IC inside packing all driving control or circuit locate on a main PC Board.

<Inspection procedure>

1. Turn on breaker.
2. After Fan motor operate, off A/C by remote controller.
3. Turn off breaker for a while, then turn it ON.
   3.1. If fan motor not operate, it means an unit in Auto-restart operation. (see more detail in P. 44-45)
   3.2. If Fan motor still operate, means P.C Board mal-function. Replace P.C Board.

(For DC fan motor in RAS-12LKV-UL)

<Cause>

The IC is built in the indoor fan motor. Therefore the P.C. board is also mounted to inside of the motor.

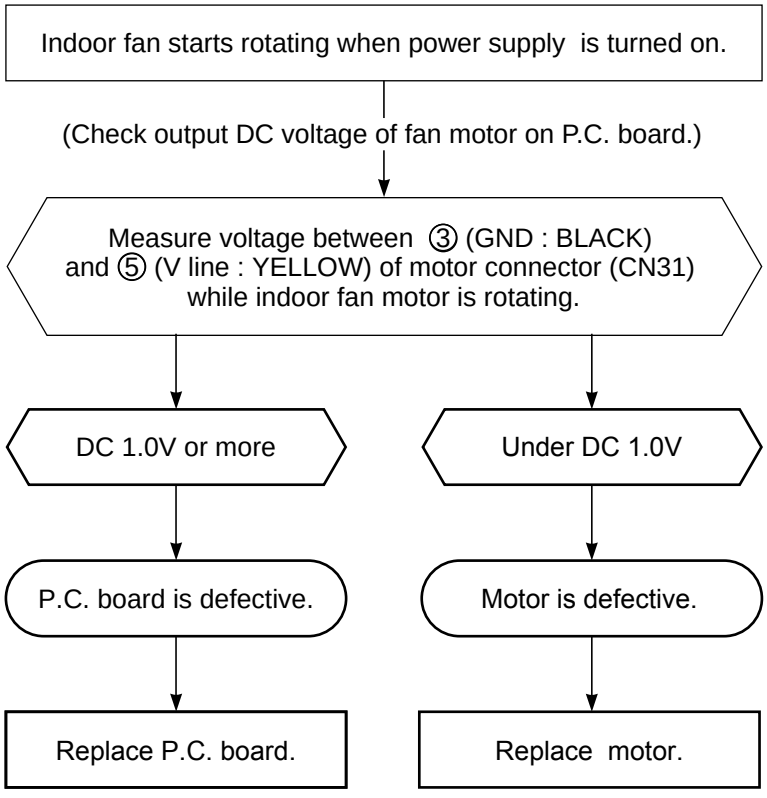
If the P.C. board is soldered imperfectly or the IC is defective, the fan motor may automatically rotate by turning on power supply.

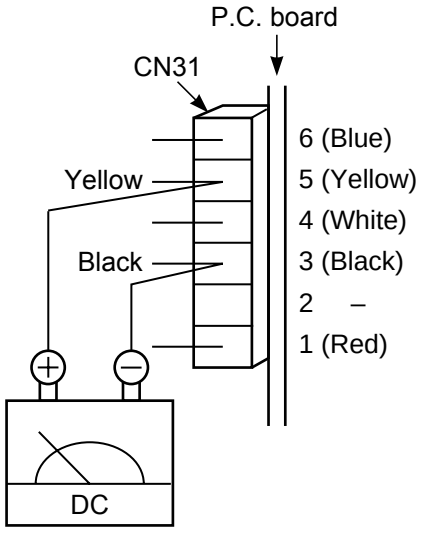
<Inspection procedure>

1. Turn on breaker.
2. After Fan motor operate, off A/C by remote controller.
3. Turn off breaker for a while, then turn it ON.
   3.1. If fan motor not operate, it means an unit in Auto-restart operation. (see more detail in P. 44-45)
   3.2. If Fan motor still operate, follow the below.
      3.2.1. Remove the grille.
      3.2.2. Remove the cover terminal by release one screw.
      3.2.3. Check DC voltage with CN31 connector while the fan motor is rotating.

NOTE :

- Do not disconnect the connector while the fan motor is rotating.
- Use a thin test rod.

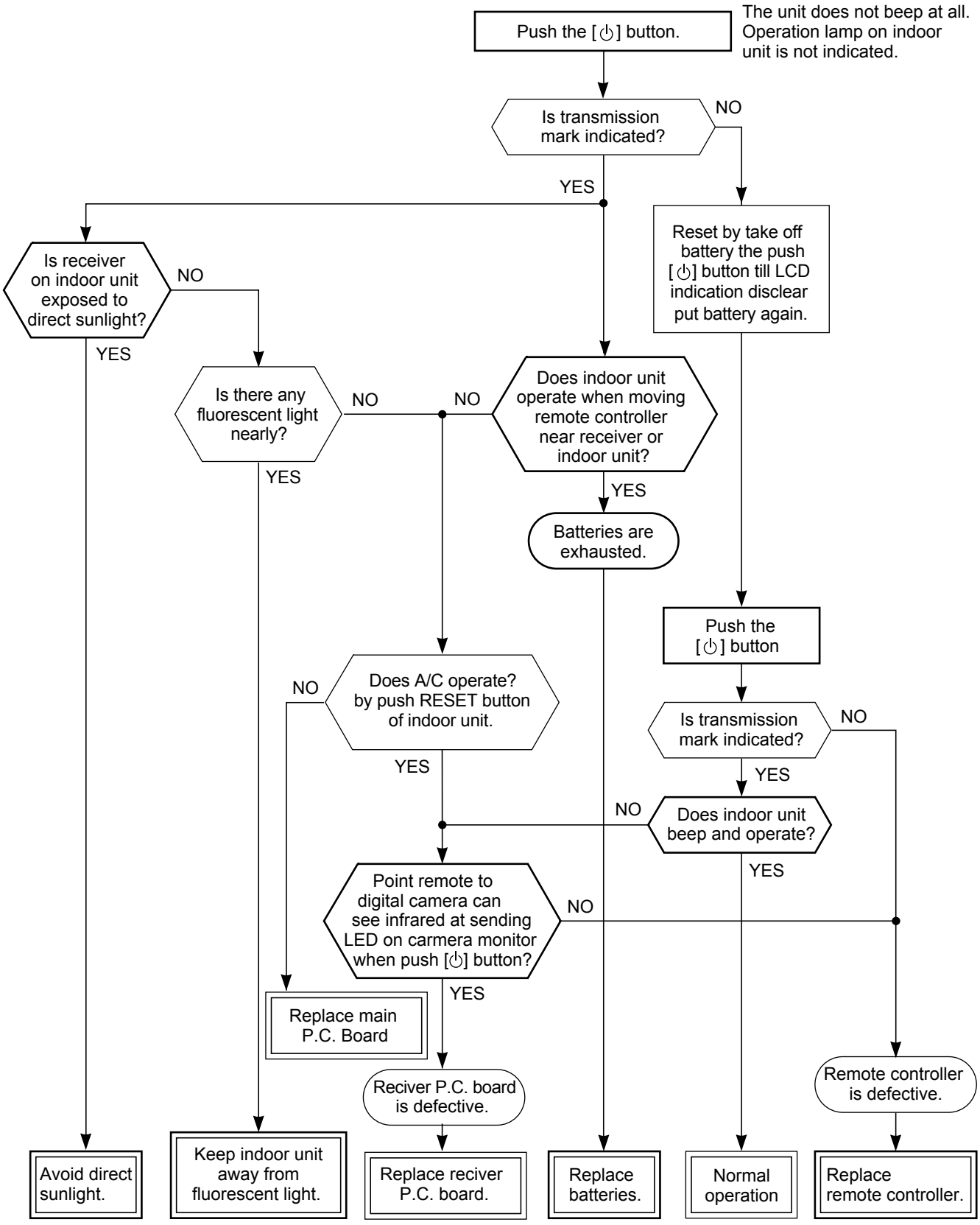




(5) Troubleshooting for remote controller

<Primary check>

Check that A or B selected on the main unit is matched with A or B selected on the remote controller.



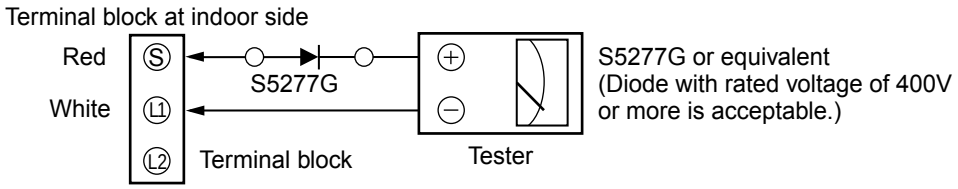
11-5-2. Wiring Failure (Interconnecting and Serial Signal Wire)

(1) Outdoor unit does not operate

1) Is the voltage between Ⓛ1 and Ⓢ of the indoor terminal block varied?
Confirm that transmission from indoor unit to outdoor unit is correctly performed based upon the following diagram.

NOTE:

- Measurement should be performed 2 minutes and 30 seconds after starting of the operation.
- Be sure to prepare a diode for judgment.

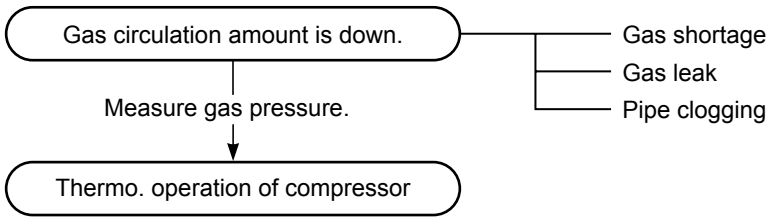


Normal time : Voltage swings between DC15 and 60V. ..... Inverter Assembly check (**11-8-1.**)
Abnormal time : Voltage does not vary.

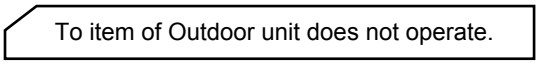
(2) Outdoor unit stops in a little while after operation started

<Check procedure> Select phenomena described below.

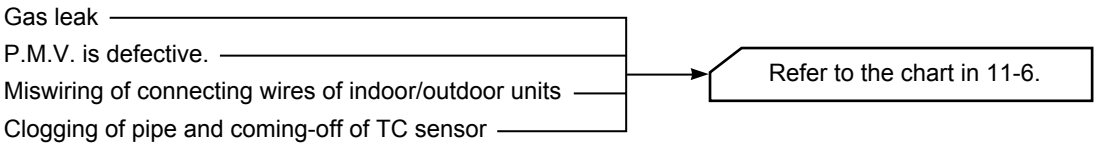
1) The outdoor unit stops 10 to 20 minutes after operation started, and 10 minutes or more are required to restart the unit.



2) If the unit stops once, it does not operate until the power will be turned on again.

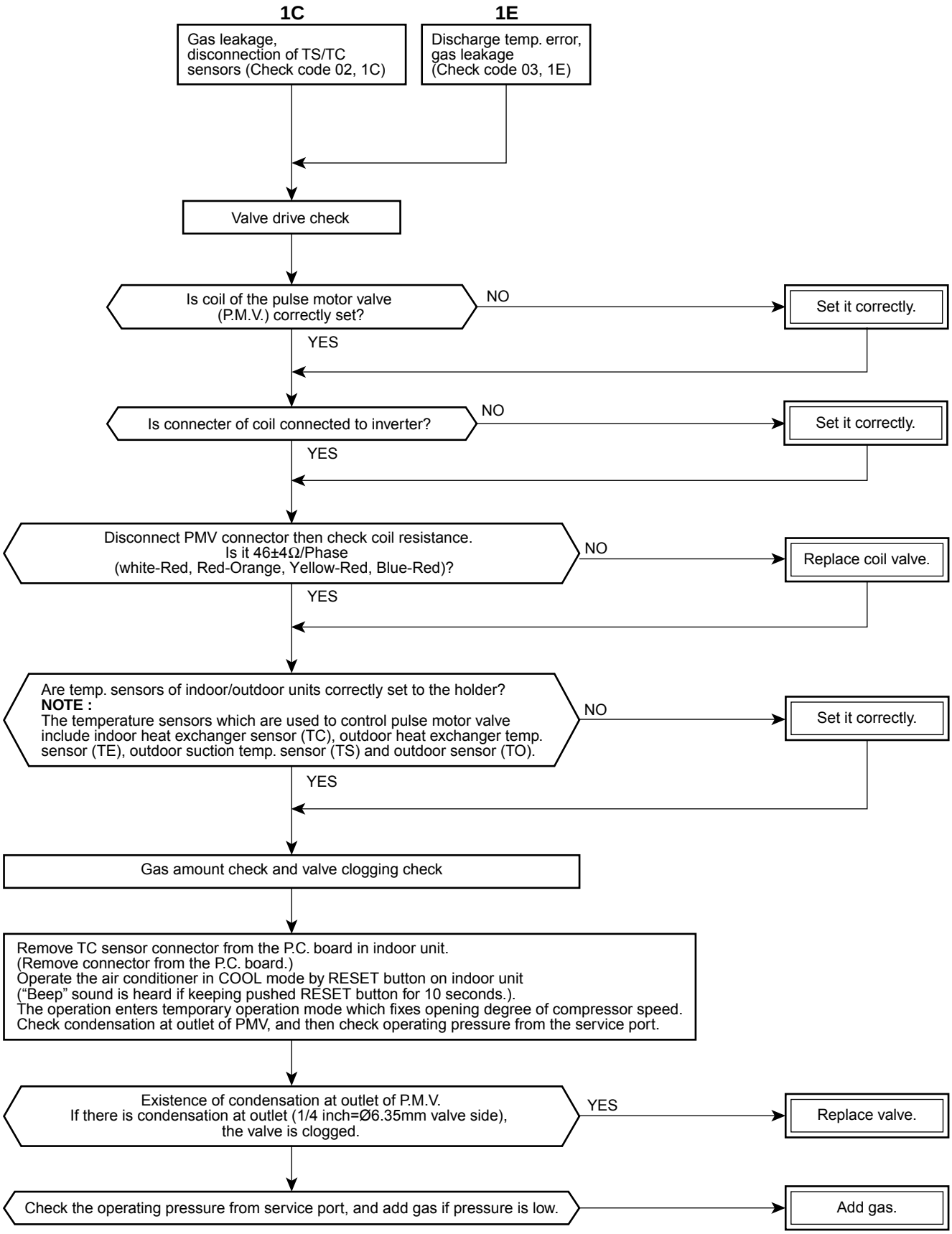


3) The outdoor unit stops 10 minutes to 1 hour after operation started, and an alarm is displayed.
(Discharge temp. error check code 03, 1E Sensor temp. error check code 02, 1C)

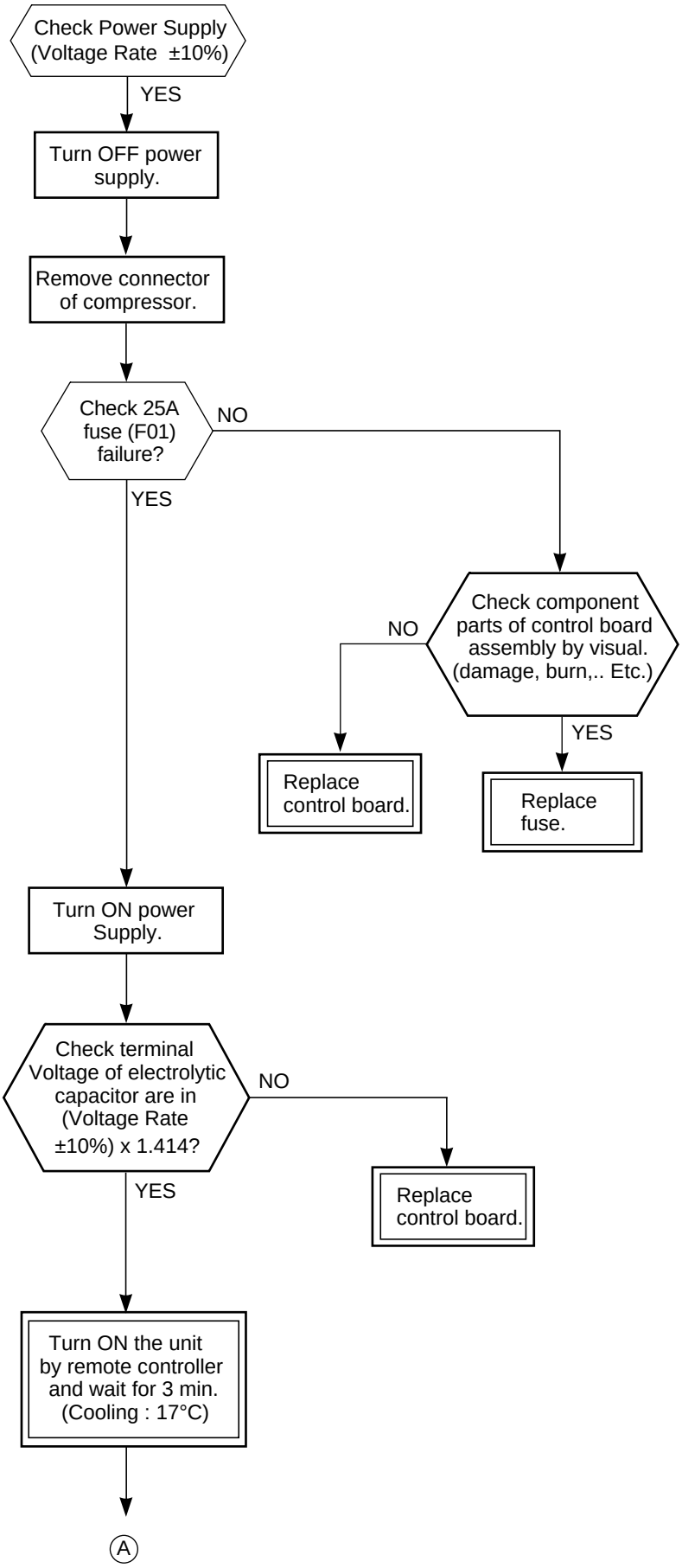


11-6. Check Code 1C (Miswiring in indoor/outdoor units) and 1E

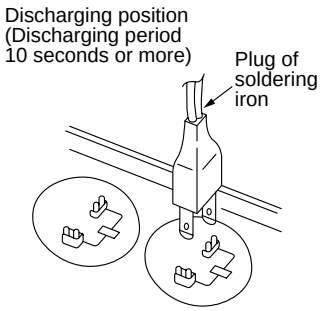
<Check procedure>

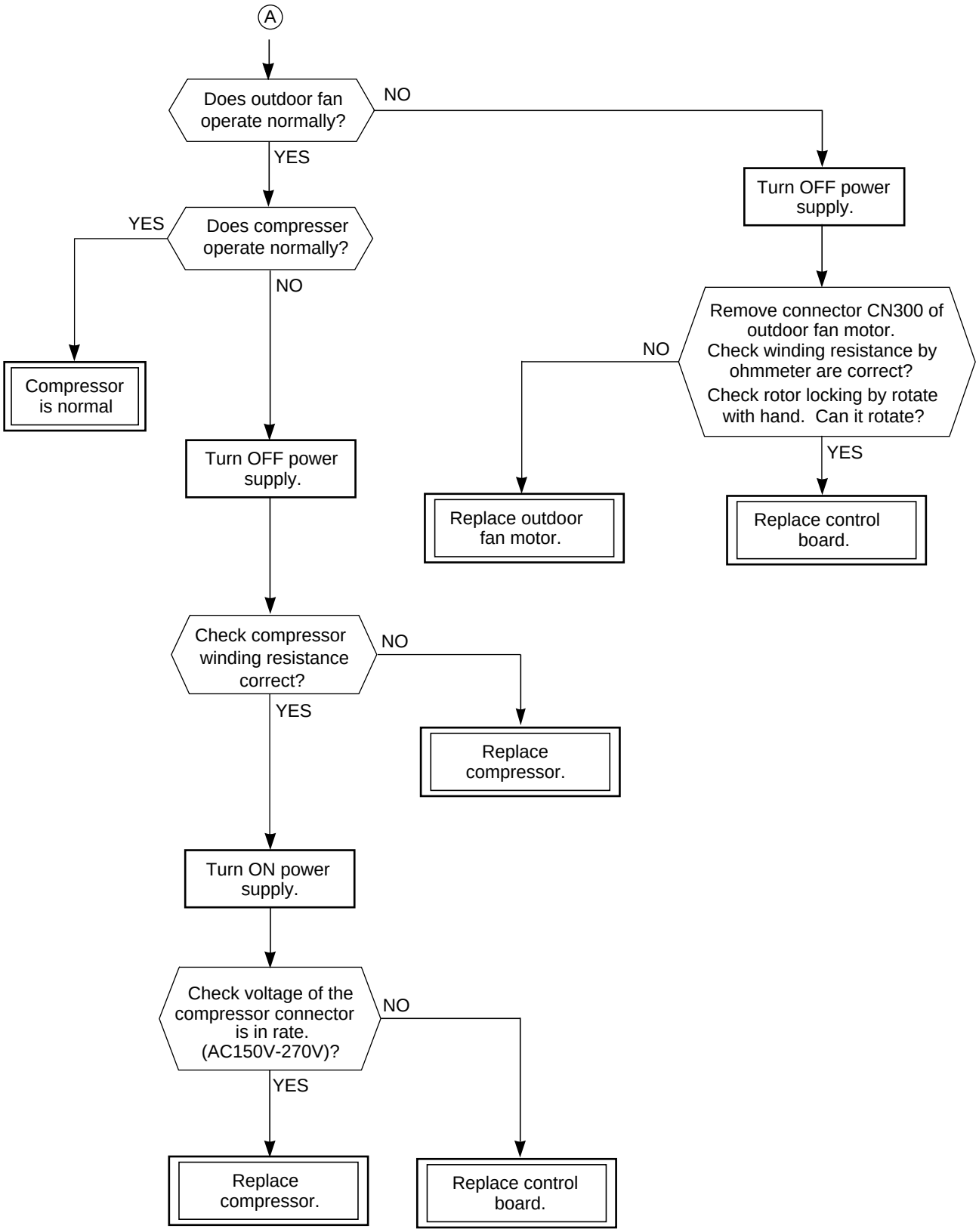


11-7. How to Diagnose Trouble in Outdoor Unit



- Connect discharge resistance (approx. 100Ω, 40W) or soldering iron (plug) between +, – terminals of the electrolytic capacitor (500μF) of C14 (with printed CAUTION HIGH VOLTAGE) on P.C. board.




A
Does outdoor fan operate normally?
NO
YES
Turn OFF power supply.
Remove connector CN300 of outdoor fan motor.
Check winding resistance by ohmmeter are correct?
Check rotor locking by rotate with hand. Can it rotate?
NO
YES
Replace outdoor fan motor.
Replace control board.
Does compresser operate normally?
YES
NO
Compressor is normal
Turn OFF power supply.
Check compressor winding resistance correct?
NO
YES
Replace compressor.
Turn ON power supply.
Check voltage of the compressor connector is in rate. (AC150V-270V)?
NO
YES
Replace compressor.
Replace control board.

11-8. How to Check Simply the Main Parts

11-8-1. How to check the P.C. board (Indoor unit)

(1) Operating precautions

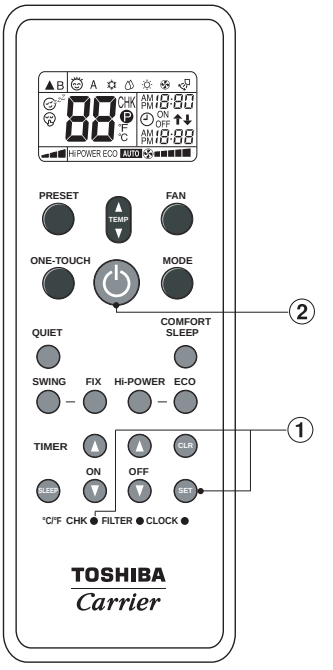
1) When removing the front panel or the P.C. board, be sure to shut off the power supply breaker.
2) When removing the P.C. board, hold the edge of the P.C. board and do not apply force to the parts.
3) When connecting or disconnecting the connectors on the P.C. board, hold the whole housing. Do not pull at the lead wire.

(2) Inspection procedures

1) When a P.C. board is judged to be defective, check for disconnection, burning, or discoloration of the copper foil pattern or this P.C. board.
2) The P.C. board consists of the following 2 parts
   a. Main P.C. board part:
   DC power supply circuit (5 V, 12 V),
   Indoor fan motor control circuit, CPU and peripheral circuits, buzzer, and Driving circuit of louver.
   b. Indication unit of infrared ray receiving
   Infrared ray receiving circuit, LED:

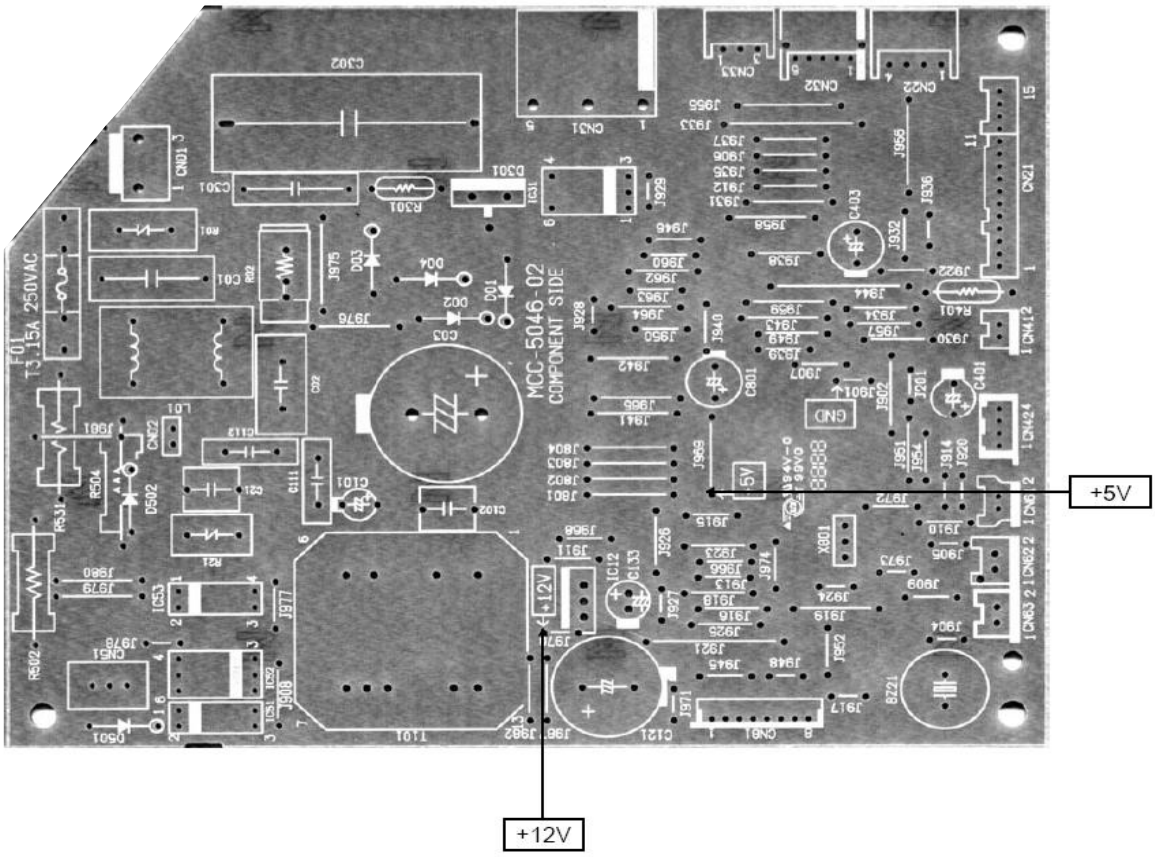
11-8-2. How to shorten time for start the compressor.

1. Turn on remote.
2. Setting requirment operation.
3. Push off remote.
4. Press [SET] button while pressing [CHECK] button with a tip of a pencil.
5. Then press [⏻] button to transmit the signal to the indoor unit.

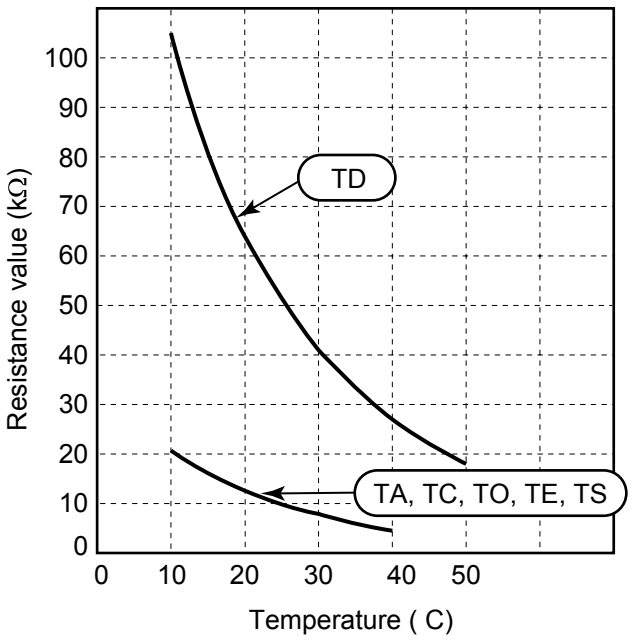


This setting helps to shortern a compressor waiting period when operate cool, heat or dry mode.
A compressor suddenly starts one order of Remote controller is received.

11-8-2. P .C . Board Layout
(RAS-09LKV-UL)

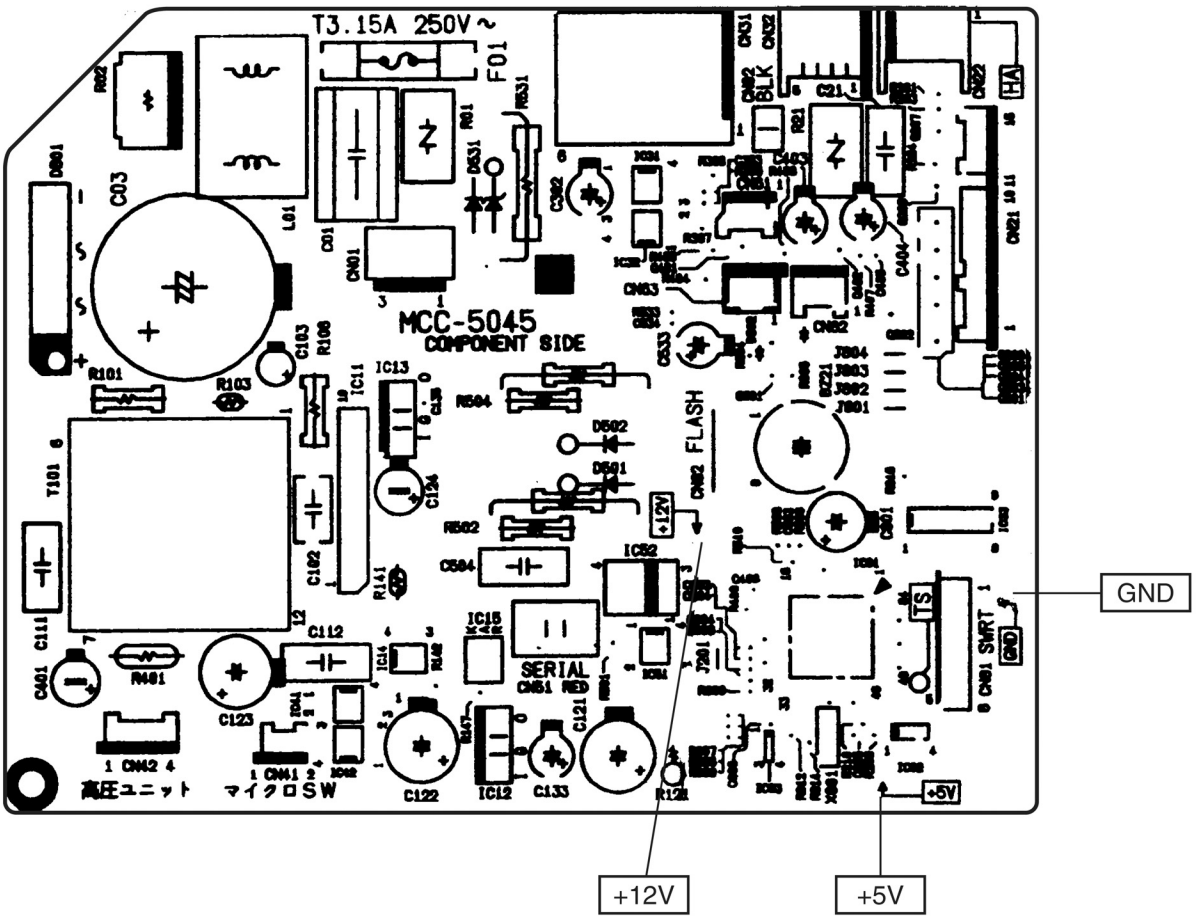


[1] Sensor characteristic table

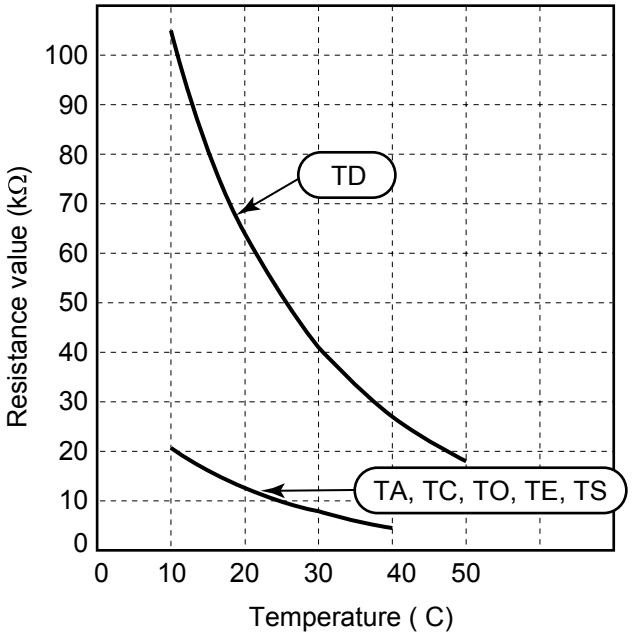


TD : Discharge temp. sensor
TA : Room temp. sensor
TC : Heat exchanger temp. sensor
TO : Outdoor temp. sensor
TE : Outdoor heat exchanger temp. sensor
TS : Suction temp. sensor

(RAS-12LKV-UL)

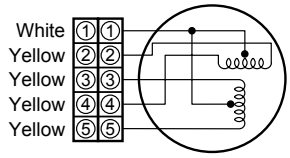


[1] Sensor characteristic table



TD : Discharge temp. sensor
TA : Room temp. sensor
TC : Heat exchanger temp. sensor
TO : Outdoor temp. sensor
TE : Outdoor heat exchanger temp. sensor
TS : Suction temp. sensor

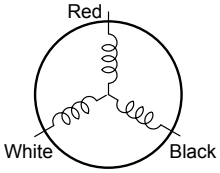
11-8-3. Indoor Unit (Other Parts)

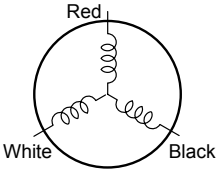
<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Room temp. (TA) sensor
Heat exchanger (TC) sensor</td><td>Disconnect the connector and measure the resistance value with tester.
(Normal temp.)
<table>
<tr><th>Sensor \ Temperature</th><th>10°C</th><th>20°C</th><th>25°C</th><th>30°C</th><th>40°C</th></tr>
<tr><td>TA, TC (kΩ)</td><td>20.7</td><td>12.6</td><td>10.0</td><td>7.9</td><td>4.5</td></tr>
</table></td></tr>
<tr><td>2</td><td>Remote controller</td><td>Refer to 11-5-1. (5).</td></tr>
<tr><td>3</td><td>Louver motor
MP24Z3T</td><td>Measure the resistance value of each winding coil by using the tester.
(Under normal temp. 25°C)
 

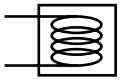
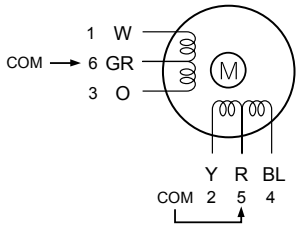
<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>1 to 2
1 to 3
1 to 4
1 to 5</td><td>250 ± 20Ω</td></tr>
</table></td></tr>
<tr><td>4</td><td>Indoor fan motor</td><td>Refer to 11-5-1. (3) and (4).</td></tr>
</table>

11-8-4. OutdoorUnit

<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Compressor
(Model : DA111A1F-20F2)
RAS-12LAV-UL

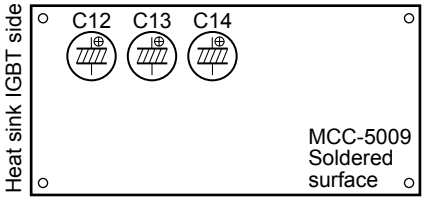
(Model : DA89X1C-23FZ2)
RAS-09LAV-UL</td><td>Measure the resistance value of each winding by using the tester.
 

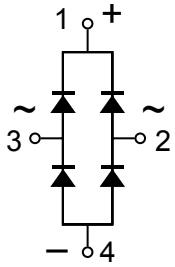
<table>
<tr><th rowspan="2">Position</th><th colspan="2">Resistance value</th></tr>
<tr><th>DA111A1F-20F1</th><th>DA89X1C-1F-23FZ</th></tr>
<tr><td>Red - White</td><td rowspan="3">0.88 to 0.98Ω</td><td rowspan="3">1.04 to 1.16Ω</td></tr>
<tr><td>White - Black</td></tr>
<tr><td>Black - Red</td></tr>
</table>
at 20ºC</td></tr>
<tr><td>2</td><td>Outdoor fan motor
(Model : ICF-340UA0-2)</td><td>Measure the resistance value of winding by using the tester.
 

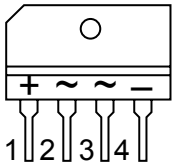
<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>Red - White</td><td>20 to 22Ω</td></tr>
<tr><td>White - Black</td><td>20 to 22Ω</td></tr>
<tr><td>Black- Red</td><td>20 to 22Ω</td></tr>
</table>
at 20ºC</td></tr>
<tr><td>3</td><td>4-way valve coil
(Model : STF)</td><td>Measure the resistance value of winding by using the tester.
 
<table>
<tr><th>Resistance value</th></tr>
<tr><td>1435 ± 144Ω</td></tr>
</table>
at 20°C</td></tr>
<tr><td>4</td><td>Pulse motor valve coil
(Model : CAM-MD12TCTH-4)</td><td>Measure the resistance value of winding by using the tester.
 

<table>
<tr><th>Position</th><th>Resistance value</th></tr>
<tr><td>Gray - White</td><td>42 to 50Ω</td></tr>
<tr><td>Gray - Orange</td><td>42 to 50Ω</td></tr>
<tr><td>Red- Yellow</td><td>42 to 50Ω</td></tr>
<tr><td>Red- Blue</td><td>42 to 50Ω</td></tr>
</table>
at 20°C</td></tr>
<tr><td>5</td><td>Outdoor temperature sensor (TO), discharge temperature sensor (TD), suction temperature sensor (TS), outdoor heat exchanger temperature sensor (TE)</td><td>Disconnect the connector, and measure resistance value with the tester.
(Normal temperature)
<table>
<tr><th>Sensor \ Temperature</th><th>10°C</th><th>20°C</th><th>25°C</th><th>30°C</th><th>40°C</th><th>50°C</th></tr>
<tr><td>TD (kΩ)</td><td>100</td><td>64</td><td>50</td><td>41</td><td>27</td><td>18</td></tr>
<tr><td>TO,TS,TE (kΩ)</td><td>20.7</td><td>12.6</td><td>10.0</td><td>7.9</td><td>4.5</td><td>—</td></tr>
</table></td></tr>
</table>

11-8-5. Checking Method for Each Part

<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Electrolytic capacitor
(For boost, smoothing)</td><td>1. Turn OFF the power supply breaker.
2. Discharge all three capacitors completely.
3. Check that safety valve at the bottom of capacitor is not broken.
4. Check that vessel is not swollen or exploded.
5. Check that electrolytic liquid does not blow off.
6. Check that the normal charging characteristics are shown in continuity test by the tester.
 

<table><tr><th>Case that product is good</th></tr><tr><td>Pointer swings once, and returns slowly. When performing test once again under another polarity, the pointer should return.</td></tr></table>
C12, C13, C14 → 500μF</td></tr>
<tr><td>2</td><td>Diode block</td><td>1. Turn OFF the power supply breaker.
2. Completely discharge the four electrolytic capacitors.
3. Remove the diode block from the PCB (which is soldered in place).
4. Use a multimeter with a pointer to test the continuity, and check that the diode block has the proper rectification characteristics.
 



(DB01)
<table><tr><th colspan="2">Tester rod</th><th rowspan="2">Resistance value in good product</th></tr><tr><th>⊕</th><th>⊖</th></tr><tr><td>~ 2</td><td rowspan="2">+ 1</td><td rowspan="3">∞</td></tr><tr><td>~ 3</td></tr><tr><td rowspan="2">– 4</td><td>~ 2</td></tr><tr><td>~ 3</td><td></td></tr></table>
10 to 20 Ω when the multimeter probe is reversed</td></tr>
</table>

11-9. How to Simply Judge Whether Outdoor Fan Motor is Good or Bad

1. Symptom

- Outdoor fan motor does not rotate.
- Outdoor fan motor stops within several tens seconds though it started rotating.
- Outdoor fan motor rotates or does not rotate according to the position where the fan stopped, etc.

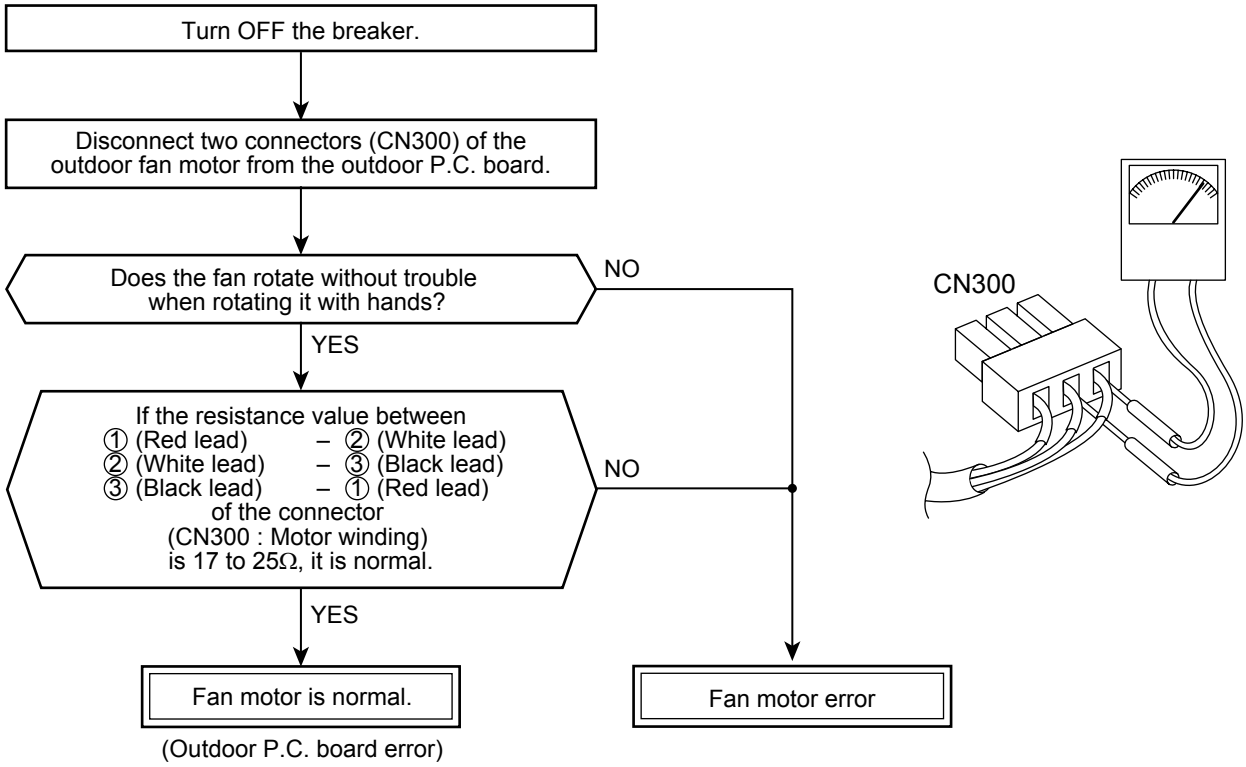
Remote controller check code “02 : Outdoor block, 1A : Outdoor fan drive system error”

2. Cause

The following causes are considered when the outdoor fan motor does not normally rotate.

1) Mechanical lock of the outdoor fan motor
2) Winding failure of the outdoor fan motor
3) Position-detect circuit failure inside of the outdoor fan motor
4) Motor drive circuit failure of the outdoor P.C. board

3. How to simply judge whether outdoor fan motor is good or bad



NOTE :

However, GND circuit error inside of the motor may be accepted in some cases when the above check is performed.

When the fan motor does not become normal even if P.C. board is replaced, replace the outdoor fan motor.

12. HOW TO REPLACE THE MAIN PARTS

WARNING

- Since high voltages pass through the electrical parts, turn off the power without fail before proceeding with the repairs.

  Electric shocks may occur if the power plug is not disconnected.
- After the repairs have been completed (after the front panel and cabinet have been installed), perform a test run, and check for smoking, unusual sounds and other abnormalities.

  If this check is omitted, a fire and/or electric shocks may occur.
  Before proceeding with the test run, install the front panel and cabinet.
- Ensure that the following steps are taken when doing repairs on the refrigerating cycle.
  1. Do not allow any naked flames in the surrounding area.
     If a gas stove or other appliance is being used, extinguish the flames before proceeding.

     If the flames are not extinguished, they may ignite any oil mixed with the refrigerant gas.
  2. Do not use welding equipment in an airtight room.

     Carbon monoxide poisoning may result if the room is not properly ventilated.
  3. Do not bring welding equipment near flammable objects.

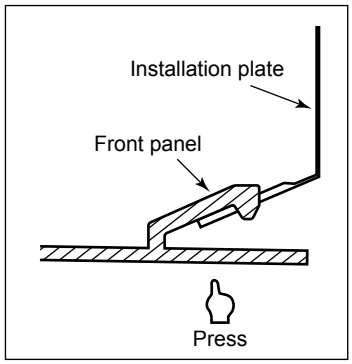
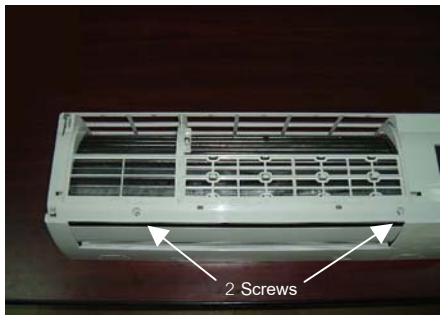
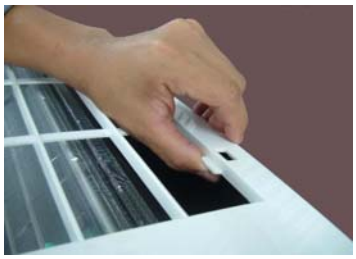
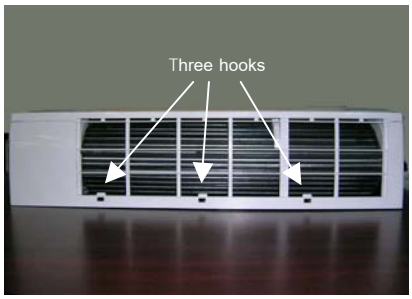
     Flames from the equipment may cause the flammable objects to catch fire.
- **If keeping the power on is absolutely unavoidable while doing a job such as inspecting the circuitry, wear rubber gloves to avoid contact with the live parts.**

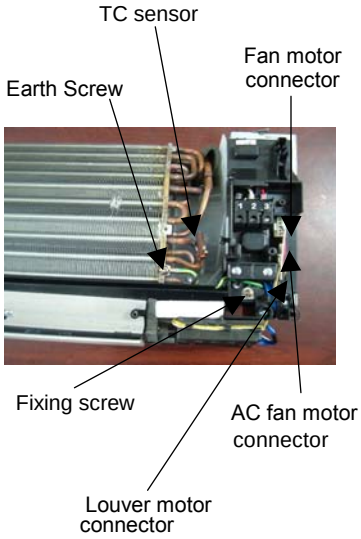
  Electric shocks may be received if the live parts are touched.
  High-voltage circuits are contained inside this unit.

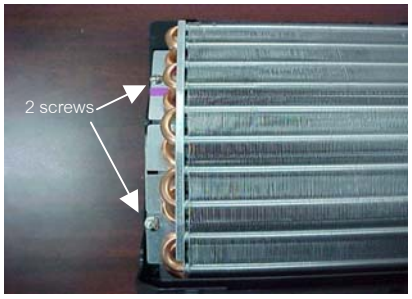
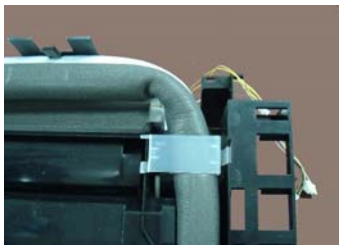
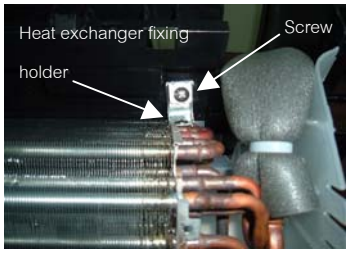
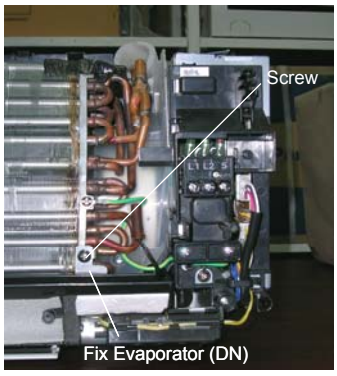
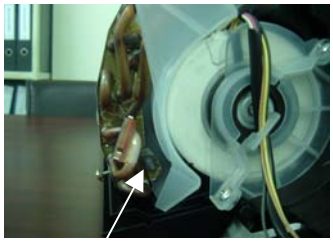
  Proceed very carefully when conducting checks since directly touching the parts on the control circuit board may result in electric shocks.

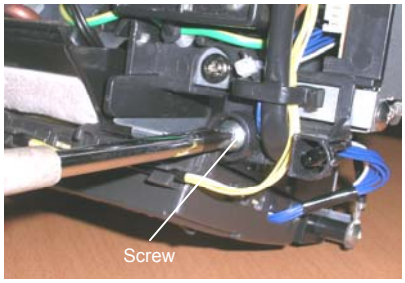
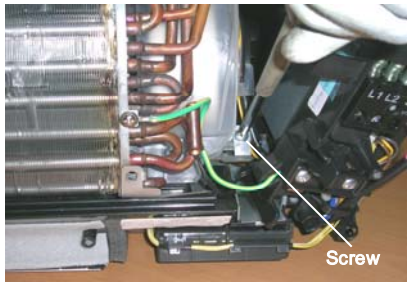
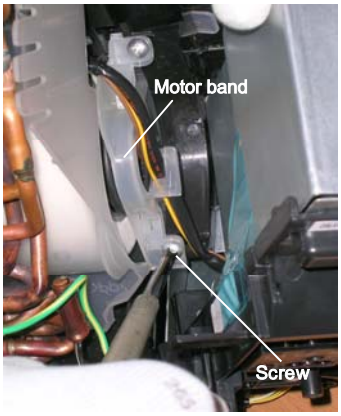
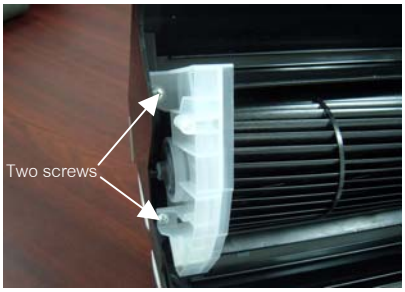
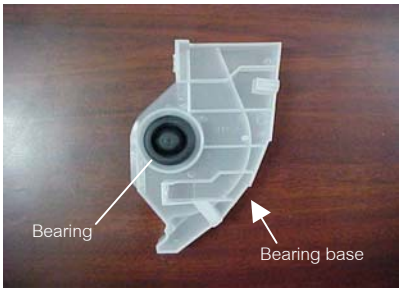
12-1. Indoor Unit

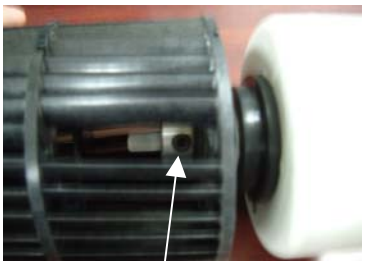
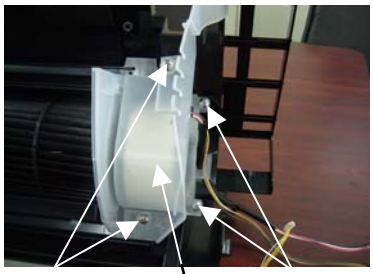
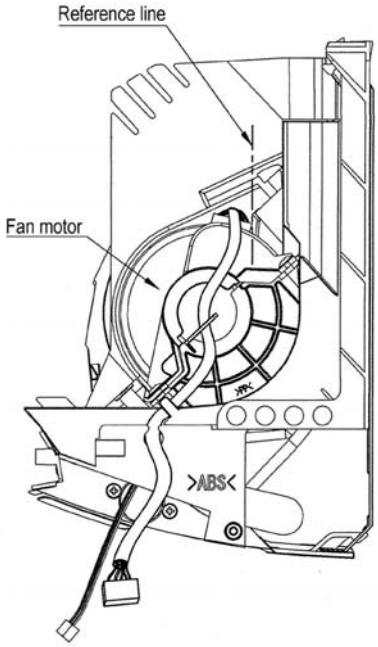
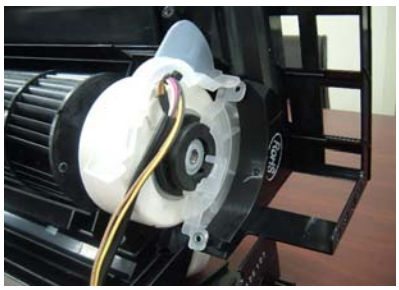
No.	Part name	Procedures	Remarks
①	Front panel	1) Stop operation of the air conditioner and turn off its main power supply. 2) Open the air inlet grille, push the arm toward the outside, and remove the grille. 3) Remove the left and right air filters.	

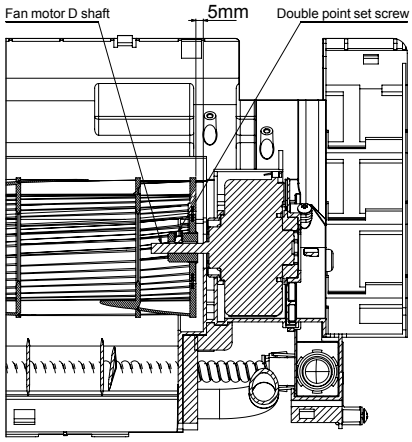
No.	Part name	Procedures	Remarks
①	Front panel	4) Press "PUSH" part under the front panel and remove hooks of the front panel from the installation plate.	
		5) Remove the front panel fixing screws. (2 pcs.) 6) Take off three hooks of panel from rear side.	
			
		<How to assemble the front panel> 1) Press three center positions and two lower center positions of the air outlet, and then hang the hanging hooks (3 pcs.) at the top side of the front panel to the rear plate.	
		2) Tighten two screws. • Incomplete hanging or incomplete pressing may cause a dewdrops or generation of a fluttering sound.	

No.	Part name	Procedures	Remarks
②	Electric parts box assembly	1) Follow the procedure up to 3) in ② above. 2) Remove screw of earth lead attached to the end plate of the evaporator. 3) Remove the lead wire cover, and remove connector for the fan motor and connector for the louver motor from the electric parts box assembly. 4) Pull out TC sensor from sensor holder of the evaporator. 5) Disengage the display unit by simply pushing at the top of the display unit. 6) Remove the fixing screw that secures the electric parts box assembly, and remove the assembly. **<How to assemble the electric parts box>** 1) Hook the top part of the electric parts box assembly onto the claws on the back body, and secure it using the fixing screw. Now attach the display unit. Connect the connectors for the fan motor and louver motor. 2) Secure the grounding wire using the fixing screw. Insert the TC sensor into the sensor holder. * Be absolutely sure to loop the grounding wire and TC sensor leads once at the bottom.	 Electric part box cover 

No.	Part name	Procedures	Remarks
③	Horizontal louver	1) Remove shaft of the horizontal louver from the back body. (First remove the left shaft, and then remove other shafts while sliding the horizontal louver leftward.)	
④	Evaporator (Heat exchanger)	1) Follow to the procedure in the item ③. 2) Remove the pipe holder from the rear side of the main unit. 3) Remove two fixing screws at the left side of the end plate of the heat exchanger.	 
		4) Remove one fixing screw on the heat exchage fixing holder to separate the heat exchage from the back body.	
		5) Remove one screw at below right side of heat exchanger that used for fixing between heat exchanger and back body by Fix Evaporator (DN) The Fix Evaporator (DN) is used for transportation only and can be removed without any concern to unit operation. Follow to 7) for removing.	
		6) Remove right side of the end plate from two fixing rib while sliding slightly the heat exchanger rightward.	

No.	Part name	Procedures	Remarks
④	Evaporator (Heat exchanger)	7) Unscrew one screw which fix Electrical Control Box and the casing. Move Electrical Control Box until can see one screw that fix Motor band and unscrew it then remove FIX-EVA-DN	 
		Tighten the screw of Motor band, assembly Electrical Control Box then tighten screw to complete reassembly.	
⑤	Bearing base	1) Follow to the procedure in the item ④ . 2) Remove the two screws used to secure the bearing base.	
		3) Remove the bearing base. **<Caution at assembling>** • If the bearing is out from the housing, push it into the specified position and then incorporate it in the main body.	

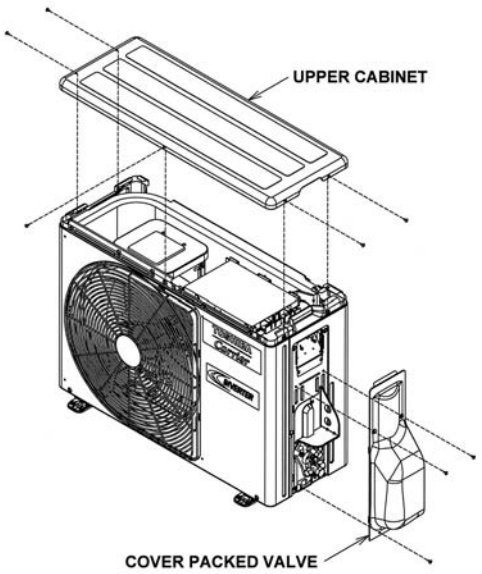
No.	Part name	Procedures	Remarks
⑥	Fan motor	1) Follow to the procedure till item ⑤. 2) Loosen the set screw of the cross flow fan. 3) Remove two fixing screws of the motor cover and them remove the motor cover. 4) Remove two more fixing screws of the motor band and remove the motor band.	 Set screw  Two screw Two screws on motor band Motor cover
		5) Pull the fan motor outward.  Reference condition of Fan Motor's assembly.	

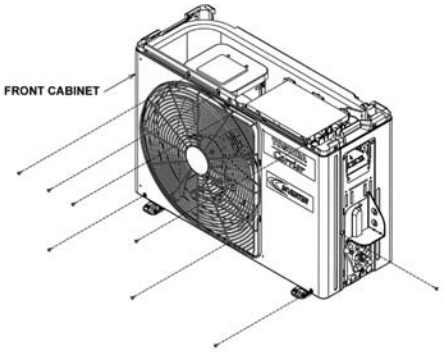
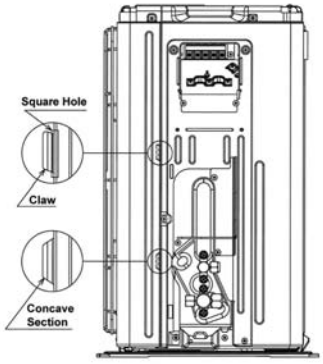
No.	Part name	Procedures	Remarks
⑦	Cross flow fan	**<Caution at reassembling>** 1) To incorporate the fan motor incorporate the motor into the position in the following figure, and then install the fan motor. • Install the cross flow fan so that the right end of the 1st joint from the right of the cross flow fan is set keeping 5.0 mm from closed wall of the main unit. • Holding the set screw, install the cross flow fan so that flat area on shaft of the fan motor comes to the mounting hole of the set screw. • Perform positioning of the fan motor as follows: • When assembling the fan motor, the fan motor must be installed in such a way that the fan motor leads will be taken out is positioned at the bottom front. • After assembling the two hooking claws of the motor band (right) into the main body, position the fan motor, insert it, and then secure the motor band (right) using the two fixing screws.	

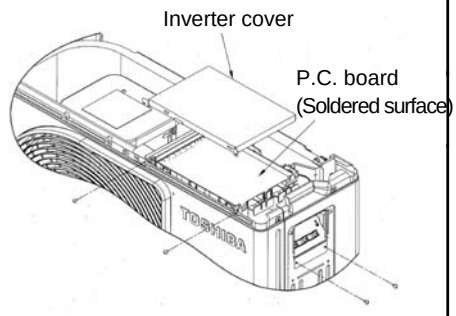
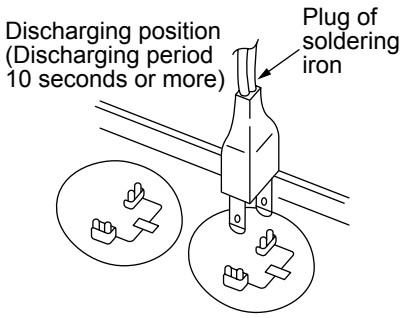
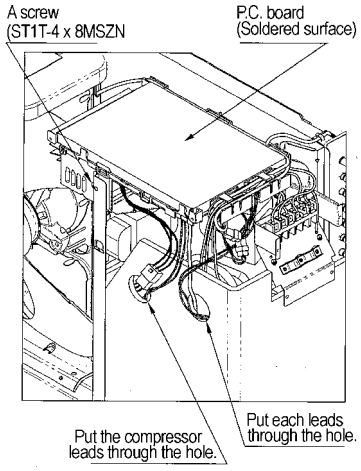
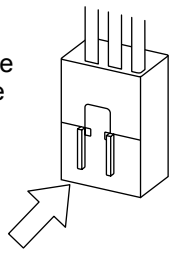
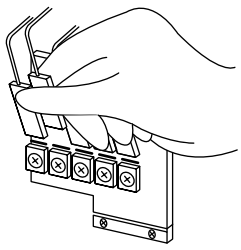
12-2. Microcomputer

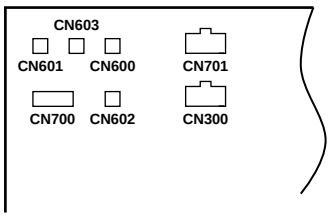
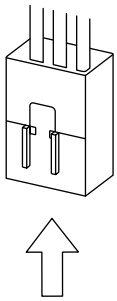
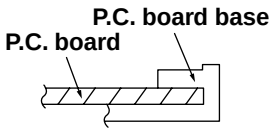
No.	Part name	Procedure	Remarks
①	Common procedure	1) Turn the power supply off to stop the operation of air-conditioner. 2) Remove the front panel. • Remove the 2 fixing screws. 3) Remove the electrical part base.	Replace terminal block, microcomputer ass'y and the P.C. board ass'y.

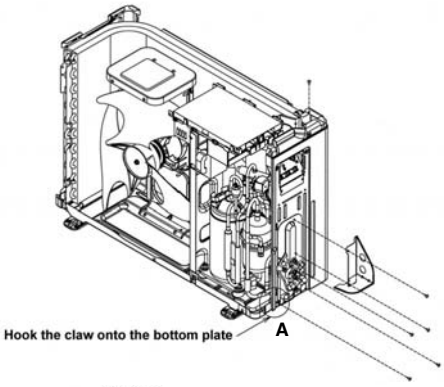
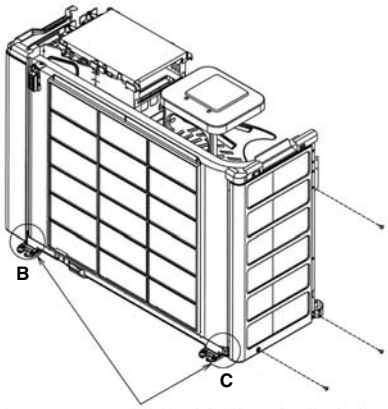
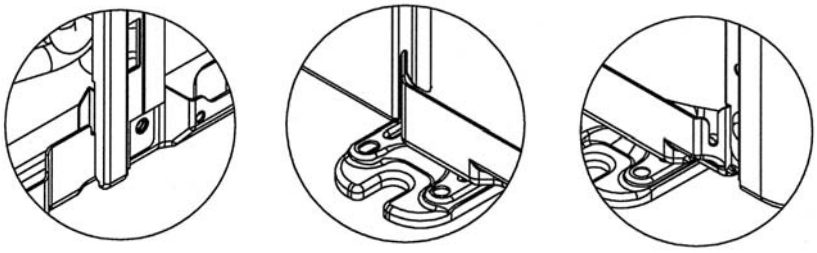
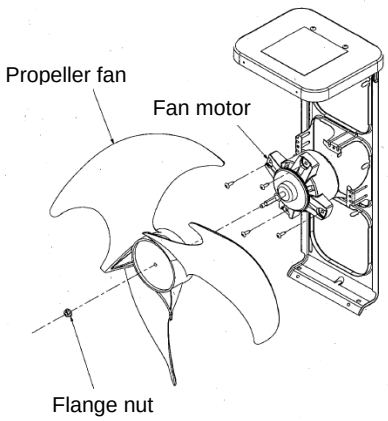
12-3. Outdoor Unit

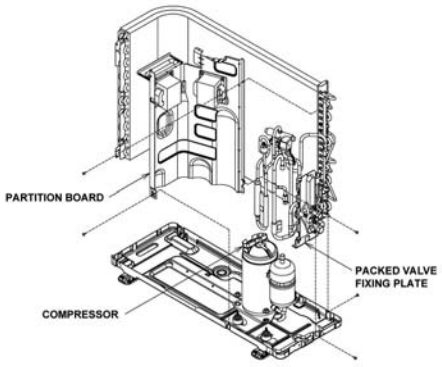
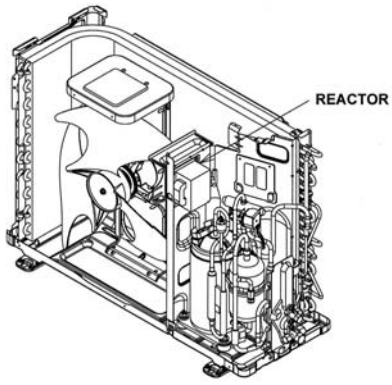
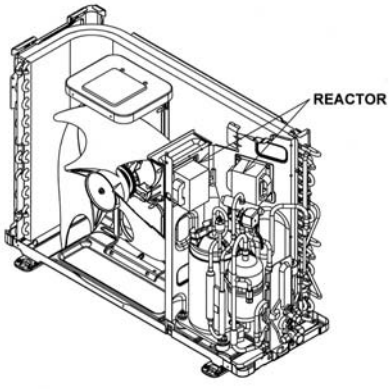
No.	Part name	Procedure	Remarks
①	Common procedure	**1. Detachment** **NOTE** **Wear gloves for this job. Otherwise, you may injure your hands on the parts, etc.** 1) Stop operation of the air conditioner, and turn off the main switch of the breaker for air conditioner. 2) Remove the valve cover. (screw 3 pcs.) • After removing screw, remove the valve cover pulling it downward. 3) Remove cord clamp (screw 3 pcs.) and then remove connecting cable. 4) Remove the upper cabinet. (screw 5 pcs.) • After removing screws, remove the upper cabinet pulling it upward. **2. Attachment** 1) Attach the upper cabinet. (screw 5 pcs.) 2) Perform cabling of connecting cable, and attach the cord clamp. • Fix the cord clamp by tightening the screws (screw 3 pcs.) fitting 2 concave parts of the cord clamp to each connecting cables. 3) Attach the valve cover. (screw 3 pcs.) • Insert the upper part into the square hole of the side cabinet, set hook claws of the valve cover to square holes (at two positions) of the main unit, and attach it pushing upward,	

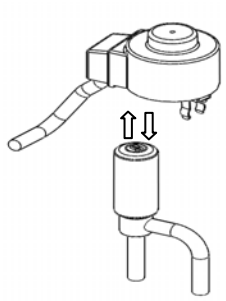
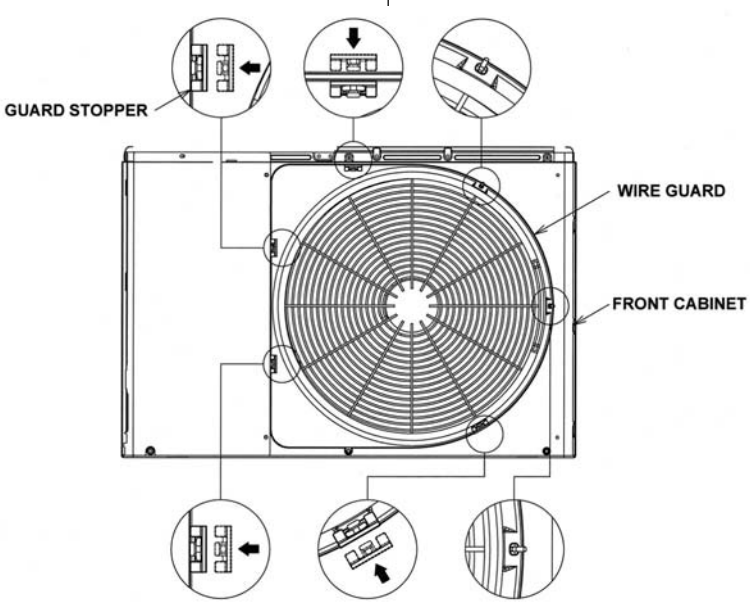
No.	Part name	Procedure	Remarks
②	Front cabinet	**1. Detachment** 1) Perform step 1 in ①. 2) Remove the fixing screws (screw 2 pcs.) used to secure the front cabinet and inverter cover, the screws (screw 3 pcs.) used to secure the front cabinet at the bottom, the screw used to secure the front and side cabinet (Right), and the screws (screw 2 pcs.) used to secure the motor base. • The front cabinet is fitted into the side cabinet (left) at the front left side so pull up the top of the front cabinet to remove it. **2. Attachment** 1) Insert the claw on the front left side into the side cabinet (left). 2) Hook the bottom part of the front right side onto the concave section of the bottom plate. Insert the claw of the side cabinet (right) into the square hole in the front cabinet. 3) Return the screws that were removed above to their original positions and attach them.	 

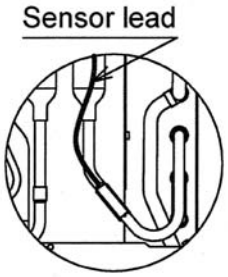
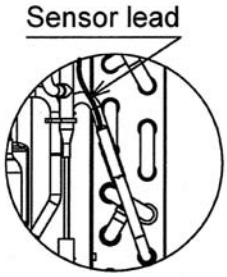
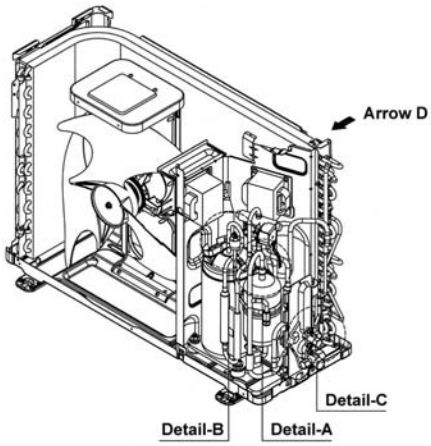
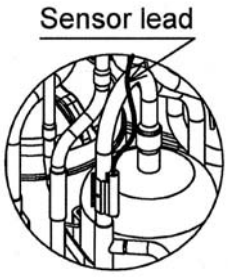
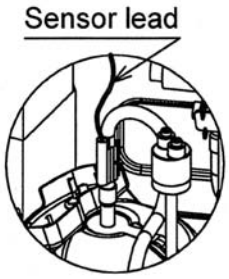
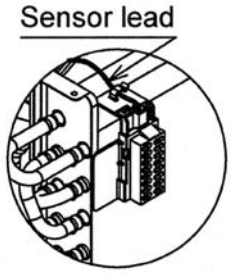
No.	Part name	Procedure	Remarks
③	Inverter assembly	1) Perform work of item 1 in ①. 2) Remove screw (ST1TØ4 × 10L 2 pcs.) of the upper part of the front cabinet. • If removing the inverter cover in this condition, P.C. board can be checked. • If there is no space above the unit, perform work of 1 in ②. **Be careful to check the inverter because high-voltage circuit is incorporated in it.** 3) Perform discharging by connecting ⊕, ⊖ polarity by discharging resistance (approx. 100Ω40W) or plug of soldering iron to ⊕, ⊖ terminals a of the C14 (printed "CAUTION HIGH VOLTAGE" is attached.) electrolytic capacitor (500μF) on P.C. board. **Be careful to discharge the capacitor because the electrolytic capacitor cannot naturally discharge and voltage remains according to trouble type in some cases.** **NOTE** **This capacitor is one with mass capacity. Therefore, it is dangerous that a large spark generates if short-circuiting between ⊕, ⊖** 4) Remove screw (ST1TØ4 x 10L 4pcs.) fixing the terminal part of inverter box to the main body. 5) Remove the front cabinet by performing step 1 in ② , and remove the fixing screws (ST1TØ4 x 10L) for securing the main body and inverter box. 6) Remove various lead wires from the holder at upper part of the inverter box. 7) Pull the inverter box upward. 8) Disconnect connectors of various lead wires. **Requirement** **As each connector has a lock mechanism, avoid to remove the connector by holding the lead wire, but by holding the connector.**	   The connector is one with lock, so remove it while pushing the part indicated by an arrow.   Be sure to remove the connector by holding the connector, not by pulling the lead wire.

No.	Part name	Procedure	Remarks
④	Control board assembly	1. Disconnect the leads and connectors connected to the other parts from the control board assembly. 1) Leads • 3 leads (black, white, orange) connected to terminal block. • Lead connected to compressor : Disconnect the connector (3P). • Lead connected to reactor : Disconnect the two connectors (2P). 2) Connectors (×8) CN300 : Outdoor fan motor (3P: white)* (* : See **Note**) CN701 : 4-way valve (2P: yellow)* CN600 : TE sensor (2P: white)* CN700 : PMV (6P: white) CN603 : TS sensor (3P: white)* CN601 :TD sensor (3P: white)* CN602 : TO sensor (2P: white) **NOTE** These connectors have a disconnect prevention mechanism: as such, the lock on their housing must be released before they are disconnected. 2. Remove the control board assembly from the P.C. board base. (Remove the heat sink and control board assembly while keeping them screwed together.) **NOTE** Disengage the four claws of the P.C. board base, hold the heat sink, and lift to remove it. 3. Remove the two fixing screws used to secure the heat sink and control board assembly. 4. Mount the new control board assembly. **NOTE** When mounting the new control board assembly, ensure that the P.C. board is inserted properly into the P.C. board support groove.	 CN300, CN701, CN600 and CN603 are connectors with locking mechanisms: as such, to disconnect them, they must be pressed in the direction of the arrow while pulling them out.  

No.	Part name	Procedure	Remarks
⑤	Side cabinet	**1. Side cabinet (right)** 1) Perform step 1 in ② and all the steps in ③. 2) Remove the fixing screw used to secure the side cabinet and heat exchanger. 3) Remove the fixing screw (screw 2 pcs.) used to secure the plate conduit and side cabinet. 4) Remove the fixing screw (screw 3 pcs.) used to secure the side cabinet to the bottom plate and valve fixing panel. **2. Side cabinet (left)** 1) Perform step 1 in ②. 2) Remove the fixing screw used to secure the side cabinet (left) onto the heat exchanger. 3) Remove the fixing screw (SCREW 2 pcs.) used for securing the side cabinet to the bottom plate and heat exchanger.	  The back body section hooked onto the bottom plate hear.  Detail A Detail B Detail C
⑥	Fan motor	1) Perform work of item 1 of ① and ②. 2) Remove the flange nut fixing the fan motor and the propeller. • Flange nut is loosened by turning clockwise. (To tighten the flange nut, turn counterclockwise.) 3) Remove the propeller fan. 4) Disconnect the connector for fan motor from the inverter. 5) Remove the fixing screws (4 pcs.) holding by hands so that the fan motor does not fall. * Precautions when assembling the fan motor Tighten the flange nut using a tightening torque of 3.3 lbf·ft (4.5 N·m).	

No.	Part name	Procedure	Remarks
⑦	Compressor	1) Perform work of item 1 of ① and ②, ③, ④, ⑤. 2) Extract refrigerant gas. 3) Remove the partition board. (screw 3 pcs.) 4) Remove the sound-insulation material. 5) Remove terminal cover of the compressor, and disconnect lead wire of the compressor from the terminal. 6) Remove pipe connected to the compressor with a burner. • Take care to keep the 4-way valve away from naked flames. (Otherwise, it may malfunction.) 7) Remove the fixing screw of the bottom plate and heat exchanger. 8) Remove the fixing screw of the bottom plate and valve fixing plate. 9) Pull upward the refrigeration cycle. 10) Remove NUT (3 pcs.) fixing the compressor to the bottom plate.	
⑧	Reactor	1) Perform work of item 1 of ②, and ③. 2) Remove screws fixing the reactors. (screw 2 pcs.) for 09LAV (screw 4 pcs.) for 12LAV	 

No.	Part name	Procedure	Remarks
⑨	Electronic expansion valve coil	**1. Detachment** 1) Perform step 1 in ②, all the steps in ③ and 1 in ⑤. 2) Remove the coil by pull it upward. **2. Attachment** 1) Insert a valve coil to value body by push it downward. And confirm to fix it surely.	
⑩	Wire guard	**1. Detachment** 1) Perform work of item 1 of ②. 2) Remove the front cabinet, and put it down so that wire guard side directs downward. **Perform work on a corrugated cardboard, cloth, etc. to prevent flaw to the product.** 3) Remove the guard stopper (4 pcs.) from hook of wire guard. 4) Turn the front cabinet into opposite site then pull wire guard up ward. **2. Attachment** 1) Insert claws (2 positions) of the wire guard in the holes of the front cabinet. Push the hook (4 positions) by hands and fix by guard stopper. **Check that all the claws & hooks are fixed to the specified positions.** 	

No.	Part name	Procedure	Remarks
⑪	TE sensor (outdoor heat exchanging temperature sensor)	• **Attachment** Install the sensor onto the straight pipe part of the condenser output pipe.  Detail C for 09LAV-UL  Detail C for 12LAV-UL	
⑫	TS sensor (Suction pipe temperature sensor)	• **Attachment** Install the senser onto the straight pipe part of the suction pipe. Be careful for the lead direction of the sensor.  Detail A for 09,12LAV-UL	 **Detail-B** TD sensor
⑬	TD sensor (Discharge pipe temperature sensor)	• **Attachment** With its leads pointed upward, install the sensor onto the vertical straight pipe part of the discharge pipe.	
⑭	TO sensor (Outside air temperature sensor)	• **Attachment** Insert the outdoor air temperature sensor into the holder, and install the holder onto the heat exchanger.	 **Arrow-D** TO sensor

CAUTION

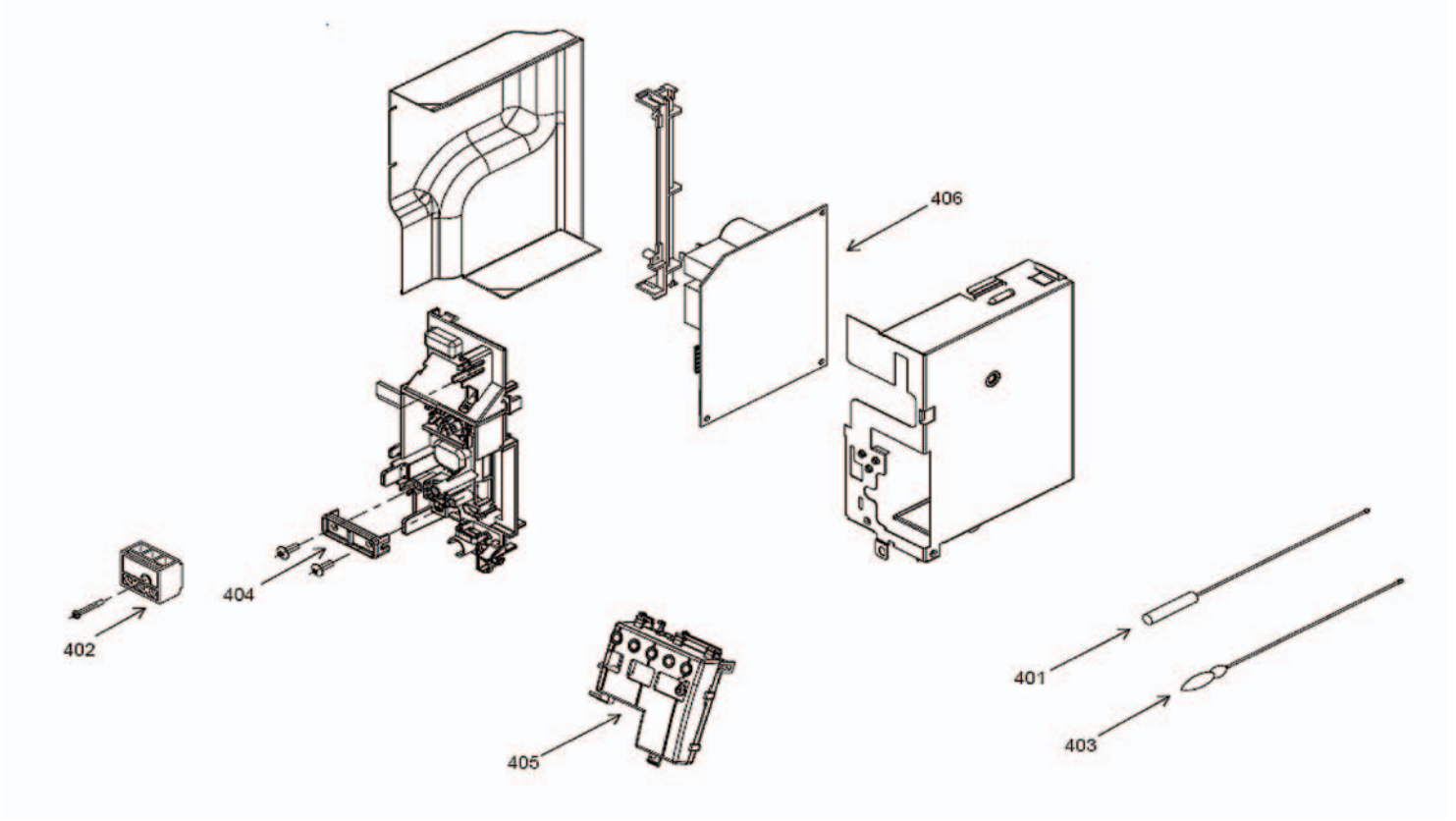
During the installation work (and on its completion), take care not to damage the coverings of the sensor leads on the edges of the metal plates or other parts. It is dangerous for these coverings to be damaged since damage may cause electric shocks and/or a fire.

CAUTION

After replacing the parts, check whether the positions where the sensors were installed are the proper positions as instructed. The product will not be controlled properly and trouble will result if the sensors have not been installed in their proper positions.

13. EXPLODED VIEWS AND PARTS LIST

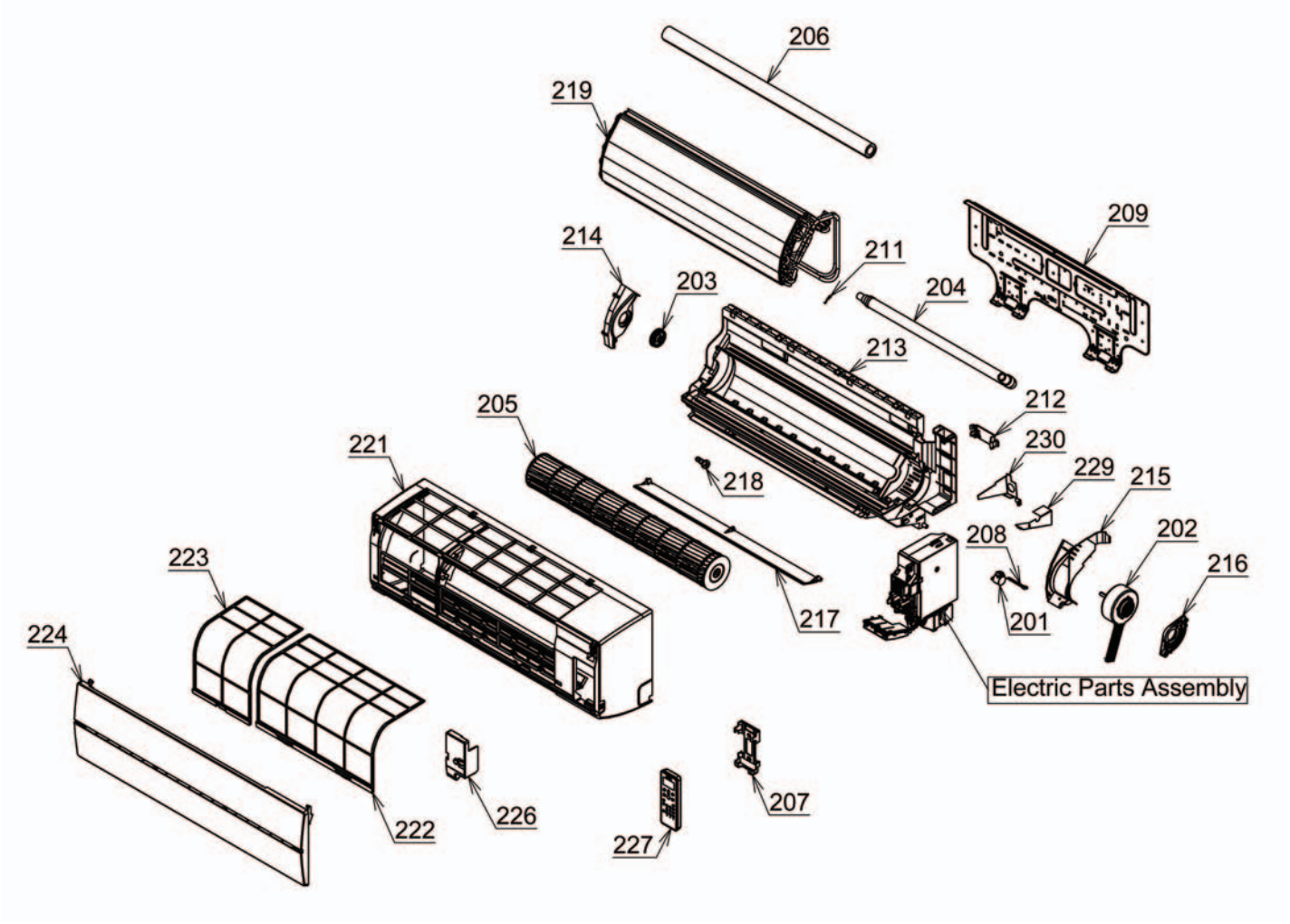
13-1. Indoor Unit (E-Part)



Location No.	Part No.	Description
401	43T50326	TEMPERATURE SENSOR
402	43T60401	TERMINAL BLOCK: 3P
403	43T50325	TEMPERATURE SENSOR
404	43T62003	CORD CLAMP
405	43T69633	PC BOARD ASSY; WRS-LED (RAS-12LKV-UL)

Location No.	Part No.	Description
405	43T69641	PC BOARD ASSY; WRS-LED (RAS-09LKV-UL)
406	43T69854	PC BOARD (RAS-09LKV-UL)
406	43T69855	PC BOARD (RAS-12LKV-UL)

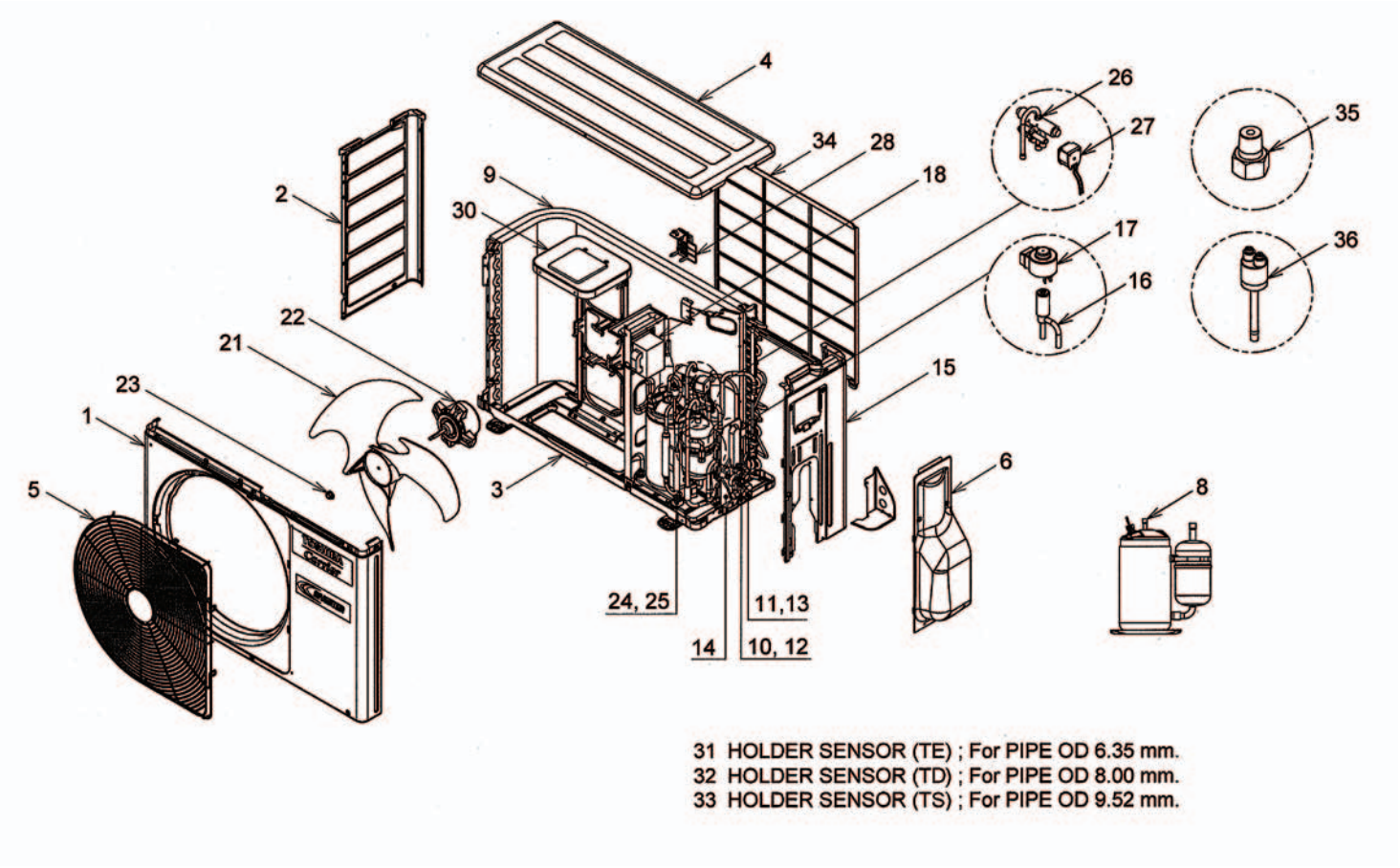
13-2. Indoor Unit



Location No.	Part No.	Description
201	43T21397	LOUVER MOTOR
202	43T21409	FAN MOTOR (RAS-09LKV-UL)
202	43T21421	FAN MOTOR (RAS-12LKV-UL)
203	43T22312	BEARING ASSY, MOLD
204	43T70313	HOSE, DRAIN
205	43T20325	CROSS FLOW FAN ASSEMBLY
206	43T11317	PIPE SHIELD
207	43T83003	HOLDER, REMOTE CONTROL
208	43T60382	MOTOR CORD
209	43T82310	INSTALLATION PLATE
211	43T19333	HOLDER, SENSOR
212	43T09408	PIPE HOLDER
213	43T03378	BACK BODY ASSEMBLY
214	43T39338	BEARING BASE

Location No.	Part No.	Description
215	43T39328	MOTOR BAND (LEFT)
216	43T39329	MOTOR BAND (RIGHT)
217	43T09409	HORIZONTAL LOUVER
218	43T79313	CAP, DRAIN
219	43T44446	REFRIGERANT CYCLE ASSEMBLY
221	43T00488	PANEL SERVICE ASSEMBLY
222	43T80318	AIR FILTER (R)
223	43T80319	AIR FILTER (L)
224	43T09457	GRILLE OF AIR INLET
226	43T62328	TERMINAL COVER
227	43T66308	REMOTE CONTROLLER WIRELESS
229	43T82311	PARTITION CONDUIT
230	43T82312	MOUNT CONDUIT

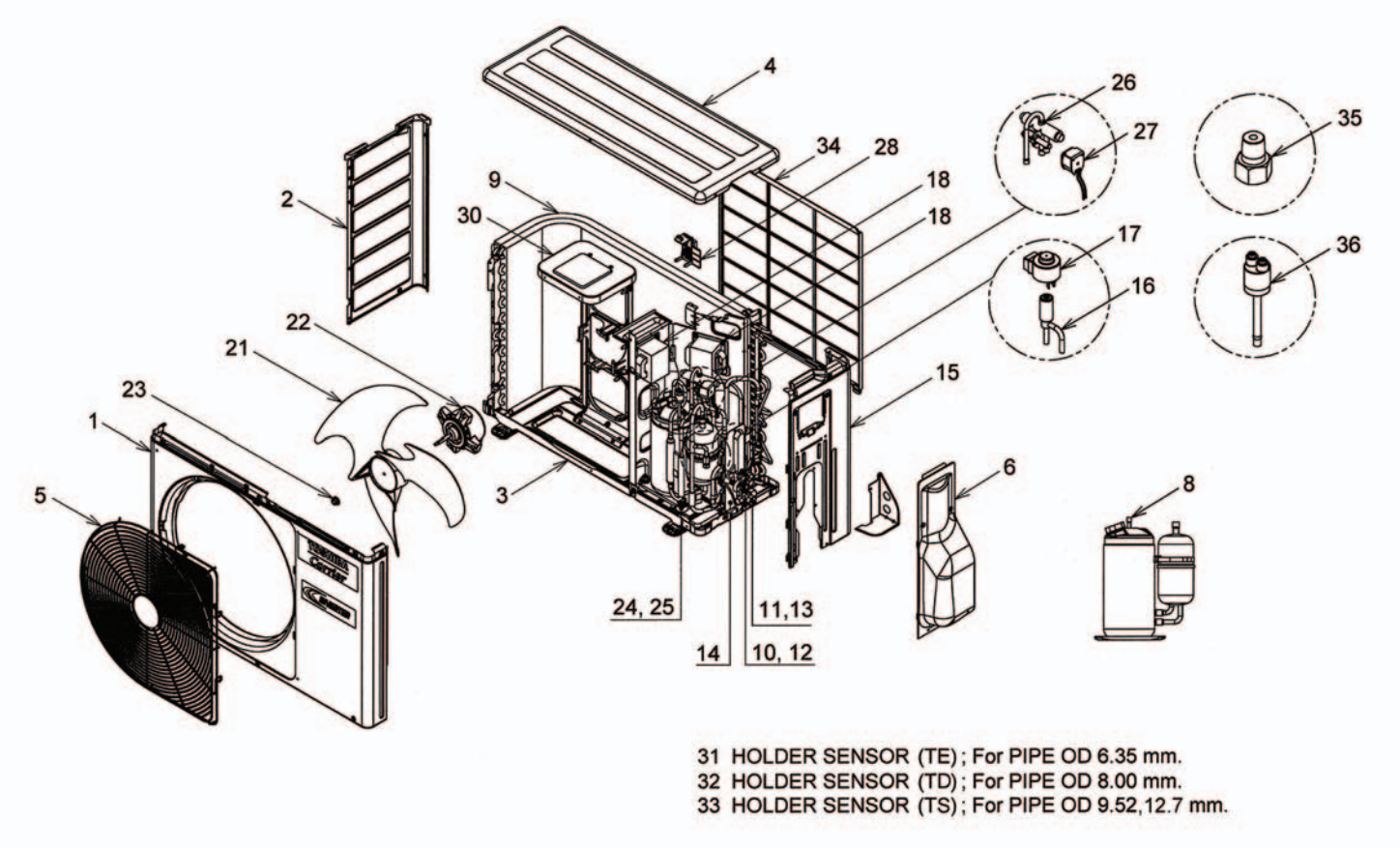
13-3. Outdoor Unit (RAS-09LAV-UL)



Location No.	Part No.	Description
1	43T00535	FRONT CABINET
2	43T00459	LEFT CABINET
3	43T42327	BASE PLATE ASSEMBLY
4	43T00452	UPPER CABINET
5	43T19342	WIRE GUARD
6	43T00540	PACKED VALVE COVER
8	43T41420	COMPRESSOR (Made in China)
9	43T43446	CONDENSER ASSEMBLY
10	43T46332	VALVE;PACKED 6.35 DIA
11	43T46331	VALVE;PACKED 9.52 DIA
12	43T47331	BONNET, 6.35 DIA
13	43T47332	BONNET, 9.52 DIA
14	43T00539	FIXING PLATE VALVE
15	43T00537	RIGHT CABINET ASSEMBLY
16	43T46360	BODY PMV
17	43T63325	COIL PMV

Location No.	Part No.	Description
18	43T46351	REACTOR
21	43T20319	PROPELLER FAN
22	43T21419	FAN-MOTOR
23	43T47001	NUT FLANGE
24	43T97001	NUT
25	43T49335	RUBBER CUSHION
26	43T46359	4WAY VALVE
27	43T63324	4WAY VALVE COIL ASSEMBLY
28	43T63319	HOLDER,SENSOR
30	43T39337	MOTOR BASE CONNECTION PLATE
31	43T63318	HOLDER,SENSOR
32	43T63317	HOLDER,SENSOR
33	43T63316	HOLDER,SENSOR
34	43T19331	FIN GUARD
35	43T49338	FUSIBLE PLUG
36	43T63330	PRESSURE SWITCH

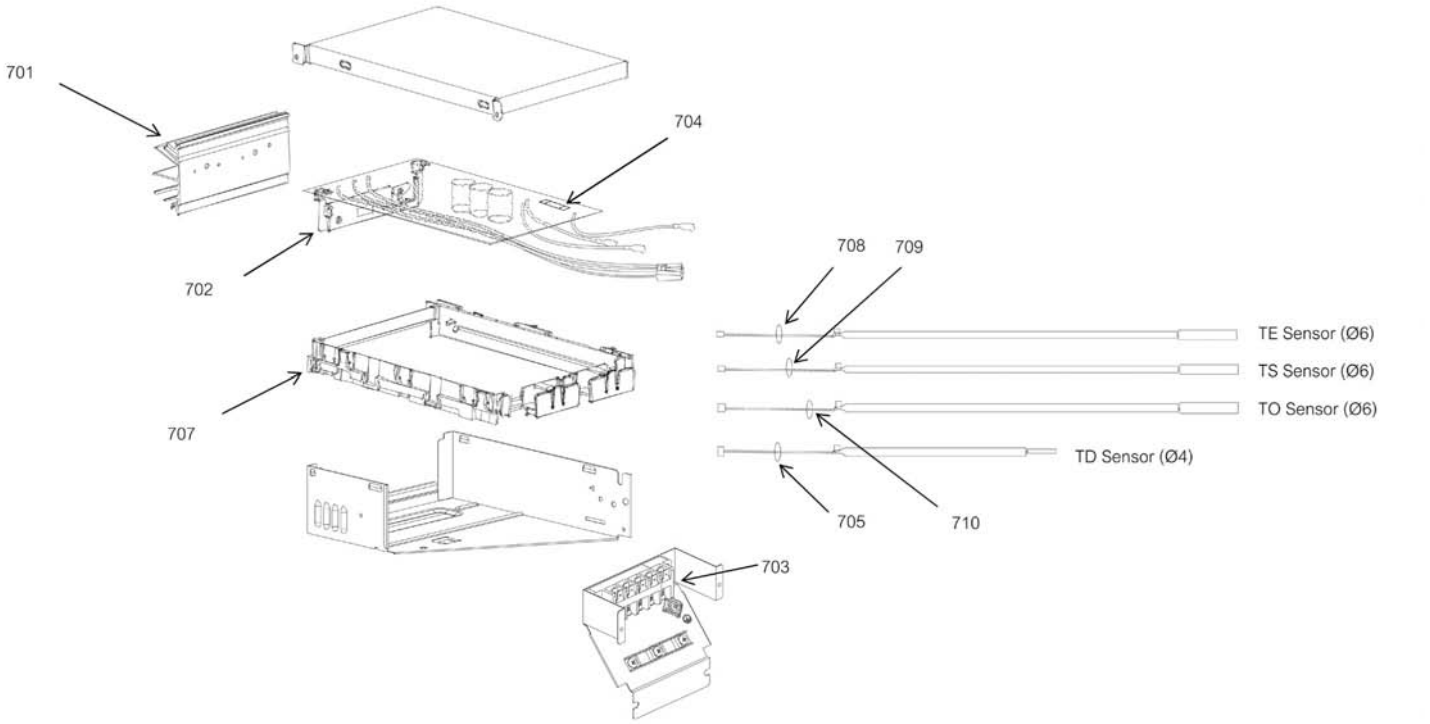
13-4. Outdoor Unit (RAS-12LAV-UL)



Location No.	Part No.	Description
1	43T00535	FRONT CABINET
2	43T00459	LEFT CABINET
3	43T42327	BASE PLATE ASSEMBLY
4	43T00452	UPPER CABINET
5	43T19342	WIRE GUARD
6	43T00540	PACKED VALVE COVER
8	43T41431	COMPRESSOR
9	43T43447	CONDENSER ASSEMBLY
10	43T46332	VALVE;PACKED 6.35 DIA
11	43T46331	VALVE;PACKED 9.52 DIA
12	43T47331	BONNET, 6.35 DIA
13	43T47332	BONNET, 9.52 DIA
14	43T00539	FIXING PLATE VALVE
15	43T00537	RIGHT CABINET ASSEMBLY
16	43T46360	BODY PMV
17	43T63325	COIL PMV

Location No.	Part No.	Description
18	43T58306	REACTOR
21	43T20319	PROPELLER FAN
22	43T21419	FAN-MOTOR
23	43T47001	NUT FLANGE
24	43T97001	NUT
25	43T49335	RUBBER CUSHION
26	43T46359	4WAY VALVE
27	43T63324	4WAY VALVE COIL ASSEMBLY
28	43T63319	HOLDER,SENSOR
30	43T39337	MOTOR BASE CONNECTION PLATE
31	43T63318	HOLDER,SENSOR
32	43T63317	HOLDER,SENSOR
33	43T63316	HOLDER,SENSOR
34	43T19331	FIN GUARD
35	43T49338	FUSIBLE PLUG
36	43T63330	PRESSURE SWITCH

13-5. P.C. Board Layout



Location No.	Part No.	Description
701	43T62320	HEATSINK
702	43T69847	PC BOARD (RAS-09LAV-UL)
702	43T69848	PC BOARD (RAS-12LAV-UL)
703	43T60404	TERMINAL-5P
704	43T60403	FUSE

Location No.	Part No.	Description
705	43T50328	TEMPERATURE SENSOR
707	43T62313	BASE-PLATE-PC
708	43T50329	SENSOR,HEAT EXCHANGER
709	43T50330	SENSOR,HEAT EXCHANGER
710	43T50331	SENSOR,HEAT EXCHANGER

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